

# ANNALS of SURGERY

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# ANNALS *of* SURGERY

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No. 2

## PENETRATING WOUNDS OF THE ABDOMEN \*

REPORTING SIXTY-THREE CASES

RECEIVED FROM PISTOL, RIFLE AND SHOTGUN MISSILES

By BYRD CHARLES WILLIS, M.D.

OF ROCKY MOUNT, N. C.

PENETRATING wounds of the abdomen, even without injury to its contents, are quite dangerous. Except in unusual injuries of the abdominal contents the time elapsing between receipt of the injury and operation is probably the greatest single factor in the recovery of all patients whose injury is not so great as in itself to cause death, as is the case in so many shotgun wounds received at short range. The amount of hæmorrhage and leakage of colon contents, with its secondary peritonitis, are the two great factors which are directly influenced by time.

In treating infections subsequent to perforations of the viscera, the length of time from soiling to operation is of paramount importance. In many of these cases perforation of the colon with escape of fæces has occurred, yet patients will recover if operated upon within two or three hours after receipt of injury. Perforations of the stomach and small intestines, even though received four to six hours before operation, are not very dangerous even when evident localized peritonitis is present. Some of these are closed without drainage, as in perforating duodenal ulcers.

In all cases certain routine treatments should be carried out; these include intravenous glucose and hypodermoclysis of saline, application of heat, prohibiting everything by mouth, antitetanic and perfringens serums, liberal use of morphine for "splinting" the abdomen, and general good nursing. The use of enemas before or after operation in injuries of the lower ileum or colon should not be allowed. The bowels will move, and more safely, without assistance.

This paper is based upon the study of sixty-three cases of perforations of the abdomen admitted to the Park View Hospital and Bass Memorial Hospital to the service of Doctors Boice and Willis, and treated by one or both during the past seventeen years. Many of these were operated upon around midnight. The patients ranged in age from six to sixty-five years, and fifty-four of them were between ten and thirty years of age inclusive. Therefore, the young and robust adult is the usual case treated. There were fifty-five males and eight females. Ten were white and fifty-three were colored. The period of time elapsing between receipt of the injury and admission to the

\* Read before The Southern Surgical Association, December, 1931.

hospital was approximately obtained in fifty-one cases, nineteen being received in two hours; twenty-one, between two and five hours; seven, from five to ten hours; four, from ten to fifteen hours; one, thirty hours, and one, four days (abscess due to perforation unsuspected). The loss of time between admission to the hospital and the operation is also a factor in our opinion. Thirty-one of the patients were operated upon within one hour (shortest, five minutes), over one hour and within two hours, twelve; two hours to five hours, six; six to ten hours, two; and one was allowed to remain in the hospital seven days to wall off his abscess. This was the patient that was sent in on the fourth day. Two patients were so moribund that they were not operated upon. In six, the time of the arrival of the patient was not recorded.

The distance and mode of transportation to hospital is important. A few of the cases were from the city; the great majority from a few miles to seventy, the greater number coming from seventeen to forty miles. They were conveyed by automobile, some sitting up and others reclining on the back seat.

We classified this series according to the amount of hæmorrhage, as Mason,<sup>1</sup> of Birmingham, reported a much higher mortality in the large-hæmorrhage group, and we agree with his findings.

	Large Hæmor- rhage	Died	Per Cent.	Total Per Cent.
Pistol shot.....	24	11	46	
Shotgun.....	6	6	100	56.66
	Small Hæmor- rhage	Died	Per Cent.	Total Per Cent.
Pistol shot.....	24	3	12.5	
Shotgun.....	4	0	0	10.71

This complication is more apt to occur in the shotgun wounds inflicted at close range.

We further classified these by the number of perforations of the solid and hollow viscera, considering the point of perforation and its exit as two separate perforations in the hollow viscera, and as one in the solid. Seventeen had one to two perforations; thirteen had three, four and five perforations; twelve had six to ten perforations; ten had over ten perforations, and six were classified as numerous or shotgun wounds. Three abdominal shotgun wounded survived without operations; therefore we are unable to specify the number of perforations. In two, a bullet passed through the abdomen without perforation of organ. One of these had a perforation of right renal vein and died of secondary hæmorrhage twelve hours after operation.

In this series twelve had one organ involved; twenty-five had two; nine had three; eight had four; two had five; five were not operated upon. These included every organ of the abdomen except the suprarenal gland and spleen. One involved the ureter; three the urinary bladder; two the gall-bladder or ducts; many the liver and stomach; many had both colon and small intestines



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at the same time, and a few had one or the other. The pancreas was involved three times. One had three ruptures of an exploded stomach, one of which was about thirteen centimetres in length in the anterior wall (shotgun case). It is not so much the organ involved, excepting the pancreas, but it is the extent of the injury that counts. Pancreatic wounds are more fatal; acute pancreatitis is apt to follow and retroperitoneal hæmorrhage is usually large. Duodenal injuries are particularly difficult to handle because of hæmorrhage obscuring the field of injury and the necessity of mobilizing the duodenum and retroperitoneal infection.

### *Classification According to Weapon*

	Case	Operated	Not Operated	Died	Mortality Per Cent.
Pistol shot.....	47	46	1	15	32
Rifle.....	2	2	0	0	0
Shotgun.....	14	10	4	7	50
Totals.....	63	58	5	22	35

One each of the pistol and shotgun groups were so moribund they were not operated upon; the former died in eighteen hours and the latter in six hours. Three of the non-operative shotgun cases survived.

### *Classification of Deaths as to Time of Occurrence Following Operation*

	Died on Table	Within 48 Hours	After 48 Hours
Pistol shot.....	3	6	5
Shotgun.....	1	5	0

There was only one post-operative obstruction that was operated upon and he survived with an enterostomy. There were other post-operative obstruction cases, both partial and complete, among those that died. Some were recognized, but their condition was so critical that it would not permit interference. Four were enterostomized at time of operation for fear of obstruction, and we think this a very valuable procedure, especially where there are perforations below an anastomosis or too few perforations to justify resection but enough to greatly impair bowel movement.

Only three patients were transfused, but we agree with Mason<sup>2</sup> that this should be done more often.

The blood-pressure was recorded in twenty-four persons. Of those recorded, five were below eighty millimetres of mercury and nineteen over 100; many of the most desperate cases were not read.

Practically every patient received hypodermoclysis on the operating table, the amount varying from 300 to 3,300 cubic centimetres, and it was kept up after putting them to bed, varying from twenty-four hours to seven days, giving 100 to 200 cubic centimetres an hour. Herndon's intravenous-drip method with 5 per cent. glucose works very nicely in these cases.

Five patients received more than one pistol-shot wound. One developed pneumonia and empyæma; sixteen had a mild peritonitis at the time of

operation; ten had complicating chest wounds, most of these severe, and many died; four had bone fractures, and in twenty-five the bullet or shot lodged in the back. The pulse rate varied from 68 to 170 at beginning of operation, and the great majority were over 100. The upper abdomen was involved in thirty-five; both the lower and upper in three; the lower in twenty-five. Upper abdominal wounds are considered more serious, due to more vital organs and larger blood-vessels. In twelve it was necessary to do an anastomosis of the bowel; in one it was necessary to do two anastomoses, as the bowel was exploded and torn across without actual injury by missiles. This patient was a shotgun case with a large perforation of anterior wall of descending colon with wads and shot in left perirenal space; he survived. He had a temporary fecal fistula. Twelve patients were deliberately not drained, and of these eight lived.

Those that survived operation stayed in the hospital from twelve to fifty-seven days. Practically all received antitetanic serum, and a great many had

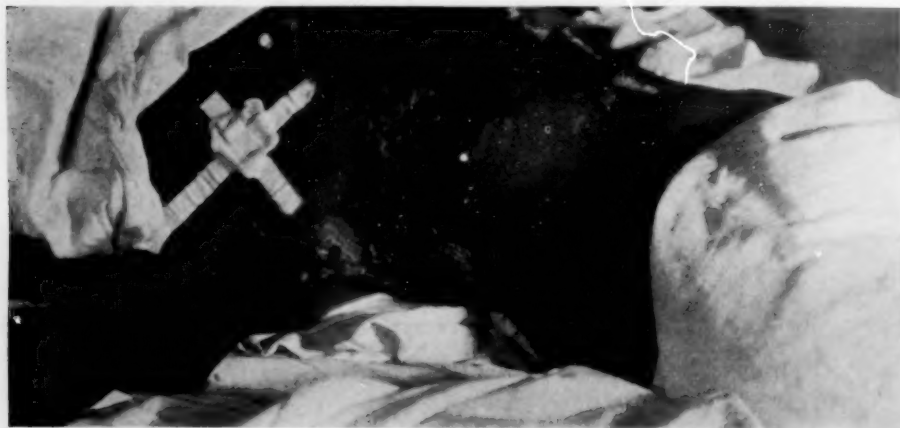


FIG. 1.—External injury from multiple gunshot charge at short range.

antiperfringens. Fifty had ether anæsthesia. Two had ether and spinal anæsthesia; four had spinal anæsthesia alone; two of these died. We do not believe spinal anæsthesia is a safe anæsthetic in these cases. One had local anæsthetic; one did not require any anæsthetic as the opening was so great in the anterior abdominal wall that his insensitive organs could readily be repaired. Two were moribund; and three deliberately not operated upon, believing this was the best treatment. These three are the real basis for reporting this series, and their histories are as follows:

CASE I.—Negro youth, aged sixteen years, admitted to hospital June 27, 1928, stating he had been shot four hours before. He was shot thirty feet from muzzle with No. 4 bird shot, and vomited blood. On examination there were eight shot holes scattered over the abdominal region. Pulse, 75; temperature, normal. He was given antitetanic serum, nothing by mouth, and hypodermoclysis. On the fifth day he was allowed liquid diet and discharged well on the tenth day. Röntgen-ray films were made before his discharge, showing some shot had apparently penetrated the abdomen.

CASE II.—Negro, aged twenty-three years, entered the hospital one hour after being

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shot by 12-gauge gun, No. 6 bird shot, muzzle about nine feet distant and about four feet above him. The load entered the lower border at the right costal margin in nipple line. There were numerous shot holes (Fig. 1), some coalescing, over an area eleven centimetres in diameter. He was not shocked; he had eaten nothing that night. He was not operated upon; was given morphine, 1/6 grain, every four hours; glucose, 100 grams intravenously on alternate days and nothing by mouth for eight days. Anterior and lateral Röntgen-ray films made about the eighth day showed numerous scattered shot in the right half of the abdomen (Fig. 2) reaching from the costal margin to the symphysis and back in the lumbar region. Colon pus was discharged through shot holes



FIG. 2.—Skiagraph of abdomen of patient shown in Fig. 1, demonstrating the scattered intra-abdominal wounds.

for nearly three weeks. The patient was discharged well on the twenty-ninth day, returning at intervals for several dressings.

CASE III.—Negress, aged fifteen years, was admitted to the hospital 1:30 A.M., September 19, 1931, for shotgun wounds abdomen, chest, left forearm and right thigh. Temperature was 98° F.; pulse, 84. The patient stated that she was sitting in her nightgown on the edge of her bed about 10:30 P.M. "tonight" when she was shot. The gun was 12-gauge and the muzzle was about twelve feet from her. The load passed through the window pane. She was sitting with her right side at about a forty-five-degree angle to the window. Practically three-fourths of the load was received in the right half of the abdomen; a few scattered shot in the chest, breasts, right thigh, and left forearm. (Figs. 3 and 4.) She was carried to the hospital, put to bed, the wounds

dressed with hot packs of boric-acid solution; morphine, 1/6 grain, every four hours was ordered and nothing given by mouth. Hypodermoclysis, normal saline 100 to 200 cubic centimetres every hour started, and 1,500 units of antitetanic and ten cubic centimetres of anaërobic antitoxin given.

By the fifth day her temperature had gradually risen to 103.5° F., reaching normal on the thirteenth day. Her pulse rose to 120 per minute on the second day and remained at that rate with slight variation until the sixth day. Nothing was allowed by mouth until the eighth day. She was given 100 grams glucose intravenously in 1,000 cubic centimetres of distilled water on the third, fifth, seventh, eighth and ninth days. She left the hospital on the twenty-fifth day, apparently well. The abdomen was examined from day to day for peritonitis and abscess.



FIG. 3.—Widely scattered gunshot wounds of abdomen; external appearance.

CASE IV.—Negro man, aged fifty years, admitted to the hospital December 12, 1930, with a pistol-shot wound of the abdomen and was operated upon, but died on the table. During exploration of the abdomen two birdshot were found in the liver and one noted in the gall-bladder wall. He no doubt had other shot that were not found. Patient had been previously shot and recovered.

Particular attention is called to the inadvisability of operating upon shotgun wounds when small birdshot have scattered throughout the abdomen, as it is hopeless and useless to try to locate all the perforations. These perforations are small and, as Bunch<sup>3</sup> says, there is no discharge of mucosa through openings. His descriptions are so clear as to the types of wounds, I wish to quote from him as follows:



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Wounds made at a distance, after the pattern of the scattering shot has enlarged and the load is no longer massed, are those of the many individual shot. A small pistol ball may make many intestinal perforations, and a load of scattered shot striking the abdomen may cause numberless perforations. A single shot may pass through the abdomen without penetrating blood-vessel or intestine, but many shot cannot pass through the abdominal wall without injury to the underlying viscera. If the shot penetrating the gut is large, the hole made by it is large, and the everted mucosa pouts through the opening automatically, keeping the wound open and preventing the probability of spontaneous healing. A shot, if it passes longitudinally through the gut-wall, may slit it for an inch or more. If the shot penetrating the intestine is small, the opening made by it may be so small that the mucosa does not pout through the serosa. Such a wound appears as an



FIG. 4.—Skiagraph of abdomen of patient shown in Fig. 3, demonstrating the widely scattered multiple intra-abdominal condition.

elongated pink dot or dash on the gut-wall. The edges fall together in proper apposition and heal readily without surgical help if the gut be kept at rest. Owing to the number of missiles penetrating the abdomen and the vascularity of the viscera, internal hæmorrhage is apt to be free. There are multiple hæmatomas from the mesentery, making particularly difficult the recognition of gut injury.

We would particularly urge that these patients be put to bed with the head of the bed elevated at a 10 to 15° angle; nothing by mouth; morphine sufficient to keep them quiet; hypodermoclysis of saline or intravenous 5 per cent. glucose with proper sterilization and dressing of external abdominal

wound. Tetanus and perfringens serums should be given and a watchful waiting policy followed. If these patients are operated upon, the surgeon will succeed only in milking the infection through the holes in the intestines, greatly shocking the patient, and these efforts will be rewarded by a general peritonitis and death. Bunch, of Columbia, S. C., reported operating upon one of these cases who was in very good condition, and, after closing numerous perforations, gave up the task, realizing that there were many more, and closed the abdomen, and the patient died two hours later.

We have been expecting some of these patients to have secondary abscesses or severe hæmorrhage, and no doubt they will occur and require operation.

The mortality in this series of sixty-three cases with twenty-two deaths is 35 per cent.

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## THE INFLUENCE OF HÆMORRHAGE IN ABDOMINAL GUNSHOT INJURIES

By FRANK L. LORIA, M.D.

OF NEW ORLEANS, LA.

FROM THE DEPARTMENT OF SURGERY OF THE TULANE UNIVERSITY SCHOOL OF MEDICINE  
AND THE NEW ORLEANS CHARITY HOSPITAL

IN 1925, the New Orleans Charity Hospital Surgical Staff, at the suggestion of Dr. Rudolph Matas, appointed a committee to study all cases of abdominal gunshot injuries admitted to the hospital and to report on the subject at the end of the year. Professor Matas was named chairman of this committee and the writer secretary. It became the duty of the secretary to observe all cases admitted to the hospital for treatment, to follow, if possible to do so, their progress while in the hospital as well as after leaving the hospital in the event of recovery, and to observe and record all autopsies on the fatal cases. The latter became possible through the kindness and courtesy of the New Orleans Parish Coroner, Dr. George F. Roeling, who rendered invaluable coöperation during the period of study. The study extended over the years 1925 and 1926. After the cases admitted during the first five months of 1927 had been observed, it became necessary to discontinue the work. However, during the period named, 137 cases of abdominal gunshot injuries were treated at this institution, eleven died at the scene of the shooting, and the author has added five cases treated at Hotel Dieu (one case), Touro Infirmary (two cases), and the Presbyterian Hospital (two cases)—making a total of 153 cases in this series. The author has felt it a duty incumbent upon him to make reports of this study, aside from the reports made to the Charity Hospital Surgical Staff and which were never published. The present communication is concerned chiefly with the types of hæmorrhage observed and the causes of death, as well as the relationship of the one to the other.

In two rather recently published reports the author had occasion to analyze and evaluate the significance of injury to the various abdominal viscera and structures of importance, and later to discuss the factors of prognostic value in abdominal gunshot injuries. The discussion in each instance was based on the detailed study of 112 cases of this type comprising the entire group treated at the Charity Hospital during the years 1925 and 1926. In each of the presentations the very important rôle played by hæmorrhage in these cases was only casually mentioned, it being felt that a discussion involving this phase of the subject might be better given in a future report.

It was not until about July, 1925, that it was decided to classify hæmorrhage seen in these cases into slight, moderate, and massive. From then on the author classified each case as best possible in accordance with this classification. The cases which had already been observed were the most difficult

to classify from this point of view and the greatest number of the "undetermined type of hæmorrhage" group really come from them. Their histories were again reviewed and the records in the coroner's office again consulted for any remarks regarding the amount of blood lost in each case. In a large number of cases the writer observed the amount of blood lost while watching the laparotomy or at the autopsy in the event of a fatality. When it was impossible to observe the operation the operator of the particular case was consulted in regard to this as well as other features concerning the case at hand and the data recorded. The differentiation of the types of hæmorrhage in this series, therefore, is more or less approximate, there being no definite line of demarcation between them. Blood counts were not made because the indications for operation were usually based upon the clinical picture. No laboratory method of any kind was used which might have given a more accurate idea as to the severity of the hæmorrhage. In each case, therefore, the quantity of blood lost was a matter of estimation, the interpretation of which was left to the observation of one of several persons—particularly the operator of the case. The writer realizes and agrees that this was not altogether desirable. However, under the circumstances it was impossible to do otherwise. Again, the personal equation was a matter of great importance and various operators probably interpreted the amount of hæmorrhage in their cases somewhat differently.

No definite amount of blood lost was used as a basis from which to draw conclusions. However, although the amount of blood lost was not measured in any case, the loss of an amount up to 500 cubic centimetres was considered as slight; up to approximately 1,500 cubic centimetres as moderate; and above this the hæmorrhage was looked upon as massive. Each of the cases dying at the scene of the shooting disclosed an abdomen filled with blood at autopsy, with injury to some large blood-vessel. Several presented multiple gunshot wounds. Four of the five cases treated at the above-named private institutions presented massive types of hæmorrhage. In the fifth patient, who died of general peritonitis, the type of hæmorrhage could not be determined.

*History of Abdominal Injuries.*—One of the earliest references to a penetrating abdominal injury is given by Xenophon in his *Anabasis*. The case was that of a Greek captain who, after being wounded, made his way back to camp holding his bowels in his hands. Various ancient authors tell about the treatment of these injuries, most of which were of course caused by swords, knives, and other sharp or blunt instruments. In most cases the injury was chiefly an evisceration and surprisingly frequently the victim recovered. Gunshot injuries of the abdomen naturally were not seen until after the introduction of gunpowder and its use in firearms, some time during the fourteenth or fifteenth century. At first, the velocity of the bullet being relatively low, the injuries were less extensive. As the type of firearm improved and the velocity of the bullets increased, the wounds became more serious. Guthrie, in 1827, gives an excellent description of the management



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of this type of injury during the latter part of the eighteenth and early part of the nineteenth centuries. One of the most popular therapeutic measures during this time and up through the Crimean War in such injuries was bleeding or blood-letting. Since then, however, this practice very rightfully has been discontinued. It was during the Crimean War that Baudens suggested a small exploratory opening into the abdomen to determine the presence or absence of bleeding into the peritoneal cavity. If the sponge was returned without evidence pointing to active bleeding, the cavity was closed, otherwise the opening was enlarged and an attempt to arrest the hæmorrhage made. In a small monograph, published in 1891, Martin and Hare likewise stressed the importance of hæmorrhage in these cases. The early statistics during the World War showed a very high mortality until these cases were handled more thoroughly at the clearing stations nearer the front. Many who might otherwise have succumbed to hæmorrhage were saved by earlier explorations. The loss of blood and the adequate treatment of hæmorrhage have been recognized to be factors of great prognostic importance in the successful treatment of these cases.

In 1918, Fonio called attention to the importance of transfusions in gunshot wounds of the abdomen, the priority of which he ascribes to Agote. Rather recently Mason, in a study of 127 cases of gunshot and other injuries to the abdomen, reasoned that the greatest cause of death in these cases is hæmorrhage. He divided his cases into a "large hæmorrhage series" and a "small hæmorrhage series." The mortality in the former group was 87.2 per cent., and in the latter group 36.1 per cent. This author is convinced that more of these individuals could be saved if transfusions were used more frequently. A few months ago Billings and Walking, in reviewing the experiences of the Pennsylvania Hospital in Philadelphia, from 1909 to 1930, inclusive, outlined briefly the histories of 136 cases of abdominal gunshot wounds. Among them were found fifteen cases showing a slight hæmorrhage, nineteen showing a moderate hæmorrhage, eighty-six showing a severe hæmorrhage, and in sixteen cases the type of hæmorrhage was not given. In the group showing a severe hæmorrhage, fifty-nine, or 68.8 per cent., died, eighteen, or 30.5 per cent., of these being moribund on admission. The remainder—forty-one cases—were judged to be sufficiently good risks for exploration.

*Charity Hospital Statistics.*—The author believes that, aside from an actual seat of war, no hospital in the world sees and treats as many cases of abdominal gunshot wounds as the New Orleans Charity Hospital. This institution affords the most excellent opportunities for the observation and management of this very serious type of injury. We have here a veritable laboratory wherein a wealth of material not seen at any time except during wartime is almost constantly at hand. From 1900 to 1931, inclusive, there have been admitted for care into this institution 1,299 cases of abdominal gunshot wounds. This figure does not include the cases in whom a diagnosis of non-penetrating abdominal gunshot wound was made, nor does it include a

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great number of cases dying during transportation to the hospital or dying in the admitting room as they arrived to be admitted. Among this number, 889 were colored and 410 white victims—a predominance of more than two-to-one in favor of the colored patients. The total number of deaths in this series of 1,299 cases was 807—giving a mortality rate of 62.3 per cent. During these thirty-two years there has been admitted to the institution one case almost every nine days, the average per annum being slightly more than forty cases.

A decennial study of the above figures shows that while the number admitted has increased slightly, each decennium the mortality has kept abreast of the admissions, there being very little variation in the proportion of cases dying.

DECENNium	ADMISSIONS	DEATHS	MORTALITY RATE PER CENT.
1900-1909.....	364	231	63.4
1910-1919.....	402	241	59.9
1920-1929.....	446	290	65.0
1930-1931.....	87	45	51.7
TOTALS 32 years.....	1299	807	62.3

CHART I.—Showing the decennial admission of cases to the New Orleans Charity Hospital since 1900 with the mortality rate for each decennium.

Prior to 1892, abdominal gunshot injuries admitted to this institution were treated conservatively. Practically none of the cases were operated upon. In 1902, Fenner reported 152 cases operated upon at this hospital from 1892 to 1901, inclusive. This author included stab wounds in the series and expressed himself in favor of exploring cases of penetrating wounds of the abdomen if they were seen sufficiently early. The mortality in this group of cases was 57.23 per cent. Apparently, the mortality increased later because a period followed during which relatively few operations were performed. It appears that only a small number of cases were operated upon up to 1914, following which explorations again seemed to be the preferable routine. Lately the loss of blood as a factor in the prognosis has come to be considered as very important. Until recently relatively few patients were given transfusions. However, during the past few years it appears that more have received this form of therapy.

*Causes of Death.*—Generally speaking, the two main causes of death in abdominal gunshot injuries are (1) extensive hæmorrhage associated with shock, and (2) general peritonitis. Other complications, such as subphrenic abscess, gangrene of a segment of intestines, pulmonary embolism, etc., form a considerably smaller group—less than 8 per cent. of the sixty-eight fatalities among the 112 cases previously reported. In that group of deaths, 92.6 per cent. died of hæmorrhage and shock (54.4 per cent.) and general peritonitis (38.2 per cent.). Subcutaneous injuries to the various abdominal viscera cause death in more or less the same way. However, in the latter type of

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injury true shock from trauma appears to be a more conspicuous factor than in gunshot wounds. On the other hand, stab wounds and even cases of severe impalement appear to show less shock than gunshot wounds. This was very interestingly observed recently in an unusual case of abdominal injury by impalement reported by Sutherland. The existence of true shock, otherwise than from hæmorrhage in abdominal gunshot wounds, has probably been overemphasized. My observations on these cases impress me with the fact that the extent of shock varies with the amount of hæmorrhage and is proportional to it. This influence of hæmorrhage on shock has lately been carefully studied by a number of investigators. Phemister and Blalock were convinced, following severe trauma to an extremity of their experimental animals, that the reason for the shock was the loss of blood into the traumatized tissues. Blalock has also repeatedly produced shock by removing large amounts of blood from the experimental animal. The greater the hæmorrhage the more severe the shock, and those animals losing the largest amounts of blood responded proportionately less favorably to the various therapeutic measures no matter how soon the treatment was begun. In this series of 153 cases, also, the greater the quantity of blood lost by the victims the more severe the shock and the worse the prognosis.

Among the 153 cases there were 100 fatalities or a mortality of 65.3 per cent. This mortality of course included eleven cases dying at the scene of the shooting, and which might rightfully be eliminated for the time being. Without them the mortality rate on the 142 cases receiving hospital attention would be 62.6 per cent. Analyzing the causes of death in this group it will be seen that fifty-five cases, or 55 per cent., of the total died of hæmorrhage and shock, thirty-four cases died as the result of general peritonitis, while only eleven cases died from all the other causes combined. The first two factors, therefore, accounted for 89 per cent. of the fatalities. The other 11 per cent. died of subphrenic abscess (one case), gangrene of a segment of bowel associated with septicæmia (four cases), pulmonary embolism (one case), intestinal obstruction (two cases), and one case each of respiratory failure, acute gastric dilatation, and bronchopneumonia with peritonitis. Hæmorrhage in the majority of cases is, therefore, directly responsible for a fatal issue. However, it is the author's belief that this factor also influences greatly a fatal termination attributable to other causes, being more or less indirectly responsible for a great many of the other deaths, especially many of the cases dying of general peritonitis.

The loss of blood is undoubtedly the most influential factor concerned in the outcome of abdominal gunshot injuries. Mason has also arrived at the same conclusion. It is true also of the present series among which twenty-one cases showed a slight hæmorrhage, forty-two a moderate hæmorrhage, sixty a massive type of hæmorrhage, and in thirty the type was not determined. A further study of the statistics reveals that the mortality rate in this series of 153 cases increased with the quantity of blood lost. Accordingly, in the first group, *i.e.*, with slight hæmorrhage, there was a mortality rate of 28.57 per

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CAUSES OF DEATH	HÆMORRHAGE			
	Slight	Moderate	Massive	Undetermined
Abscess—subphrenic.....	0	0	0	1
Pneumonia and peritonitis.....	0	1	0	0
Gangrene and septicæmia.....	0	2	2	0
General peritonitis.....	5	21	2	6
Embolism—pulmonary.....	0	0	0	1
Hæmorrhage and shock.....	0	0	52	3
Acute gastric dilatation.....	0	1	0	0
Intestinal obstruction.....	1	0	1	0
Respiratory failure.....	0	1	0	0
TOTALS.....	6	26	57	11

CHART II.—Showing the causes of death in the 100 cases dying compared to the type of hæmorrhage in each group.

cent., in the second group, *i.e.*, those with moderate hæmorrhage, the mortality was 61.9 per cent., whereas the cases with a massive hæmorrhage had a 95.00 per cent. mortality. In the undetermined group in this series there was a mortality of 36.66 per cent., which is of course somewhat difficult to interpret.

In the present series 102 cases were found to have either a moderate or massive hæmorrhage. Among these, eighty-three, or 81.4 per cent., resulted in fatalities. Since the total number of deaths was 100, it results that 83 per cent. of the fatal cases fell in these two groups. A determination of the chief cause of death in these two groups shows that fifty-two of the fifty-seven cases, or 91.2 per cent., dying in the "massive hæmorrhage group," died as the result of hæmorrhage associated with shock. On the other hand, the predominant cause of death among the twenty-six fatalities occurring in the "moderate hæmorrhage group" was general peritonitis, which was responsible for the death of twenty-one, or 80.7 per cent., of the fatal cases in this group. Although the loss of blood, into the peritoneal cavity or elsewhere, lowers the resistance of these patients, the experiments of Sparks and David would appear to indicate that an infection in the peritoneal cavity is not otherwise influenced by the presence of blood. Is it not likely that among these twenty-six fatal cases several might have recovered had it not been for the loss of that quantity of blood which actually made the difference in their resistance to the peritoneal infection? Would all of them have died of general peritonitis if they had lost only a slight amount of blood? There can be but little doubt that the loss of blood is a most influential factor even among the cases dying of general peritonitis.

The greatest cause of death in the "slight hæmorrhage group" in the present series is also general peritonitis, being responsible for five of the six fatalities. However, it is this type of case which has the best chance for recovery as shown by a comparatively lower death rate. Although most of them received injuries to the gastro-intestinal tract, the majority overcame the peritoneal infection. The occurrence of only a slight hæmorrhage in these cases is undoubtedly a very influential factor in their recovery. Among the



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group in which the type of hæmorrhage was not determined there were eleven fatal cases—three dying as the result of hæmorrhage and shock and six from general peritonitis. The other two deaths were from pulmonary embolism and subphrenic abscess.

TYPE OF HÆMORRHAGE	TOTAL	LIVED	DIED	MORTALITY RATE
				PER CENT.
Slight.....	21	15	6	28.57
Moderate.....	42	16	26	61.90
Massive.....	60	3	57	95.00
Undetermined.....	30	19	11	36.66
TOTALS.....	153	53	100	65.36

CHART III.—Type of hæmorrhage and mortality in each group.

*The Influence of Transfusion.*—One of the most difficult problems faced by the operator in the treatment of abdominal gunshot injuries is securing a donor for transfusion. There can be no doubt but that the giving of blood in these cases ranks next in importance to an intelligently planned and rapidly but carefully performed operation that is actually twofold in its purpose—first and most important the securing of bleeding points and second the repair of injuries to the hollow viscera. Unfortunately, the securing of donors in these cases is usually hard. As in all emergencies these cases are rushed to the nearest hospital frequently by individuals who are perfect strangers to them and who usually have no more than a passive inquisitive interest in them. Such individuals as a rule depart very rapidly when asked to give blood to the victim. Frequently, also, by the time the patient's family or friends get to him the blood will do little or no good. These two factors seemed to be rather paramount in the management of the 153 cases making up this series, or rather the 142 receiving hospital care. On the other hand, a great many operators feel that their task is finished as soon as the operation is completed and very little thought and time are given to the post-operative treatment of the case at hand. A great many remain content with the administration of glucose or saline by infusion or hypodermoclysis and fail to take advantage of transfusing the patient—which in the light of our present knowledge is the method par excellence in the treatment of hæmorrhage and even shock. Very often transfusion is not resorted to except as a therapeutic measure of last resort—the period during which it could have done the most good being sacrificed—and the patient succumbs in spite of it. On the other hand, many patients, though conscious upon arrival at the hospital, have lost so much blood that no amount of blood will save them or give them a better chance for life.

In the present group of 142 cases receiving hospital care, only sixteen, or 11.26 per cent., were given transfusions. This is, of course, a very small number from which to draw any conclusions. The majority of these patients were Negroes and at the New Orleans Charity Hospital the greatest difficulty is encountered in securing donors for these individuals. Among the sixteen

cases receiving transfusions one was in the "slight hæmorrhage group," seven in the "moderate hæmorrhage group," five in the "massive hæmorrhage group," and three in the group having an "undetermined hæmorrhage." Further study shows that eight recovered and that four of the fatal cases occurred in the massive hæmorrhage group. If it were possible to make any deductions from such a small number, the giving of blood to these patients would seem to exert a beneficial influence. The author feels as Mason does that more and stronger efforts should be made to secure blood for these victims.

## TYPE OF HEMORRHAGE

A	Slight		Moderate		Massive		Undetermined	
	Lived	Died	Lived	Died	Lived	Died	Lived	Died
	15	6	16	26	3	57 *	19	11

Transfusions given—type not being specified.

B	Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	0	15	1	5	4	12	3	23	1	2	4	53 *	3	16	0	11				

CHART IV. A—Mortality according to the type of hæmorrhage. B—Number of cases receiving transfusions under each type of hæmorrhage—whole or citrated blood.

\* Includes cases dying at the scene of the shooting.

SUMMARY.—Abdominal gunshot wounds form one of the most formidable groups of surgical emergencies that the surgeon is called upon to confront. Until well beyond the middle of the nineteenth century bleeding was one of the chief therapeutic measures in the management of these cases, which probably explains, in great part, the mortality of 92.5 per cent. during the Crimean War, according to Lagarde. It appears that the simple matter of discontinuing blood-letting in these cases was sufficient to allow the mortality to drop to 69 per cent. during the Franco-German War even though few if any were explored, and 67.1 per cent. during the Spanish-American War. Today, instead of bleeding, we give blood, and the addition of this therapeutic measure alone seems to have helped reduce the mortality rather materially. This, too, in spite of operative care—although there is no denying the fact that operative interference is the therapeutic measure of first importance. The factor of prime importance, therefore, in these cases, is hæmorrhage. The amount of blood lost by the victim seems to influence, more than any other single factor, the prognosis, the mortality rising proportionately and rather definitely with the amount of blood lost. General peritonitis, which still continues to be a factor of serious consideration in abdominal gunshot injuries, is only second to hæmorrhage and shock among the causes of death. It seems that up to the present time too little attention has been paid to the importance of the loss of blood in these cases. There is no doubt that transfusions are as valuable in these cases as they are in cases of ruptured ectopic pregnancies or hæmorrhage from any other cause.

Conclusions.—(1) The New Orleans Charity Hospital statistics on penetrating abdominal gunshot injuries show 1,299 cases as having been treated

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at this institution in the thirty-two years from 1900 through 1931 with a gross mortality of 62.3 per cent.

(2) A series of 153 cases of penetrating abdominal gunshot wounds, 137 of which are from the Charity Hospital, have been carefully observed and studied.

(3) The causes of death in this series have been given and an attempt made to discuss them thoroughly. Hæmorrhage and shock headed the list, having accounted for 55 per cent. of the fatalities, while general peritonitis accounted for 34 per cent. of the deaths. Only 11 per cent. died of other causes in this series.

(4) Hæmorrhage as a rule accounts for most of the shock seen in these cases, the depth of shock being directly proportional to the quantity of blood lost by the victim.

(5) The mortality increases proportionately with the amount of hæmorrhage. Cases losing less blood have a considerably better chance for recovery. The author has divided the hæmorrhage observed, grouping the various cases according to the amount of blood lost.

(6) Transfusions are of indispensable value, second in importance only to operative interference as a therapeutic measure in these cases. Only sixteen of the 142 cases receiving hospital treatment in this series were given transfusions. The mortality among them was 50 per cent.

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## PARTIAL AND TOTAL DEVASCULARIZATION OF THE STOMACH\*

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IF ONE can reason from analogy, it ought to be possible to reduce the secretions of the stomach by cutting down its blood supply—not that the stomach is essentially a gland like the thyroid, but it serves a double function, not the least part of which is most certainly of the gland type. And not only this, it has an extremely rich blood supply, which, without too great stretch of the imagination, can be likened to that of the thyroid in that it comes in at four points and is most remarkably anastomotic in character. If one can reduce the glandular activities of the thyroid by polar ligations, one ought to be able to accomplish the same thing in the same way in the stomach.

In order to test out this theory the stomachs of eighteen dogs were partially or totally devascularized, with the following results:

1.—Four dogs—lesser curvature, partially or totally devascularized. All animals recovered from the operation.

*No. 1.*—Died of distemper fourteen months later. Autopsy showed no ulcer or other abnormality connected with the stomach. Twenty-seven Ewald test meals were taken at different times after operation with an average reading of 7 free HCl, 45 combined, 52 total.

*No. 2.*—This dog is still living (November, 1931) and in good health after twenty-three months. Ten Ewald test meals were given after operation with an average reading of 10 free HCl, 39 combined, 49 total.

*No. 3.*—Was sacrificed after eight months. No ulcers or other abnormalities were noted in the stomach. Three Ewald test meals taken before operation showed an average of 4 free HCl, 44 combined, 48 total. Three Ewald test meals taken after operation showed an average of 4 free HCl, 36 combined, 40 total.

*No. 4.*—Was sacrificed fourteen months later at which time a definite ulcer one-fourth inch in diameter was found on its lesser curvature. No other ulcers were noted. Dog had been quite fat and seemed well. Four Ewald test meals taken before operation showed an average of 4 free HCl, 39 combined, 43 total. Four Ewald test meals taken after operation showed an average of 2 free HCl, 65 combined, 67 total.

SUMMARY.—Lesser curvature of stomachs of four dogs partially or totally devascularized. All dogs recovered. One showed an ulcer. Forty-four post-operative Ewald test meals given. Average reading 6 free HCl, 46 combined, 52 total.

2.—Three dogs—lesser and greater curvatures partially devascularized. All three dogs recovered from the operation.

*No. 1.*—Sacrificed fourteen days after operation because it was so ill. The stomach showed a number of hemorrhagic areas but no ulcers and no perforation. Two Ewald test meals done after operation gave average of 0 free HCl, 31.5 combined, 31.5 total. Animal was too ill to do any more.

\* From the Hunterian Laboratory of Experimental Surgery of the Johns Hopkins Medical School.

*No. 2.*—Dog had practically the same area of greater curvature devascularized but two vessels instead of one on the lesser curvature ligated, *i.e.*, twice the amount. It recovered and did perfectly well, being sacrificed thirty days after operation to see the result. The stomach looked perfectly normal. No congestion. No ulcers. Four Ewald test meals given after operation gave an average reading of 6 free HCl, 29 combined, 35 total.

*No. 3.*—Dog had practically same operation done as previous one. It recovered and was perfectly well seven months later when it got lost during the summer. Fourteen Ewald test meals given after operation gave an average reading of 9 free HCl, 40 combined, 49 total.

**SUMMARY.**—Lesser curvature and greater curvature of three dogs partially devascularized. All three recovered but one was so ill fourteen days post-operative that it had to be sacrificed. Its stomach was seriously congested and probably on the verge of sloughing. Twenty Ewald test meals were given, the average reading being 5 free HCl, 34 combined, 39 total.

*3.*—Three dogs—lesser curvature totally devascularized. Greater curvature partially devascularized. All three dogs recovered from the operation.

*No. 1.*—Died of pneumonia fifty days after operation. Stomach showed no ulcers or other abnormalities. Ten Ewald test meals given post-operatively gave average of 6 free HCl, 22 combined, 28 total.

*No. 2.*—Dog was quite well and under observation for six months, but was lost over the summer. Thirty Ewald test meals given post-operatively gave an average of 3 free HCl, 23 combined, 26 total.

*No. 3.*—Dog was quite well for six months when it died of intussusception. Stomach showed no ulcer or other abnormalities. Eight Ewald test meals given post-operatively gave an average of 9 free HCl, 30 combined, 39 total.

**SUMMARY.**—The lesser curvature was totally devascularized and the greater curvature partially devascularized in three dogs, all of which recovered and seemed normal. Stomach showed no ulcers. Forty-eight Ewald test meals were given post-operatively, with an average reading of 6 free HCl, 25 combined, 31 total.

*4.*—Three dogs—greater curvature totally, lesser curvature partially devascularized. All three recovered but died early after operation from distemper.

*No. 1.*—Died of distemper twenty-four days after operation. There was some mottling of gastric mucosa but no ulcers. Stomach contents were not blood-stained. Three Ewald test meals given post-operatively showed an average of 11 free HCl, 45 combined, 56 total.

*No. 2.*—Sacrificed five days after operation because it had bad case of distemper. Stomach showed an occasional pinhead-sized dusky area in mucosa but nothing else. Contents were not bloody. No post-operative readings.

*No. 3.*—Sacrificed thirteen days after operation because of distemper. Stomach showed slight hyperæmia of mucosa and perhaps a slight fullness of rugæ, but nothing else. Four Ewald test meals given post-operatively gave average of 12 free HCl, 66 combined, 78 total.

**SUMMARY.**—The greater curvature was totally devascularized and the lesser partially devascularized in three dogs, all of which got distemper and either died or had to be sacrificed within twenty-four days after operation. Slight hyperæmia of gastric mucosa was noted, but nothing else. Seven Ewald test meals gave an average of 8 free HCl, 37 combined, 45 total.

(The question arises as to whether these three experiments should not be thrown out of the study—until they can be repeated.)

*5.*—Five dogs—both curvatures—totally devascularized. Four died. One recovered but was lost track of.

*No. 1.*—Sacrificed seven days after operation because it was so ill. Autopsy showed roughly one-half of stomach gangrenous, the greater curvature being the part involved.

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The lesser curvature seemed uninvolved. One Ewald test meal showed 0 free HCl, 30 combined, 30 total.

No. 2.—Died three and one-half days after operation. Autopsy showed abdomen filled with bloody fluid and large irregular perforation on anterior surface of stomach near edge of greater curvature. Rest of stomach not affected. No Ewald test meals given.

No. 3.—Died six days after operation. Autopsy showed greater curvature gangrenous and throughout one-third of its extent digested. Large amount of thick, bloody fluid in peritoneal cavity. No test meals given.

No. 4.—Died one and one-half days after operation. Autopsy showed greater curvature gangrenous and digested throughout one-third of its extent, with some thick, bloody fluid in the peritoneal cavity. No Ewald test meals given.

No. 5.—Dog was living ten days after operation, at which time Ewald test meal showed 14 free HCl, 42 combined, 56 total. Seven days later test meal showed 16 free HCl, 72 combined, 88 total. After that it was lost. Average for two Ewald test meals was 15 free HCl, 57 combined, 72 total. But three tests pre-operatively showed average of 27 free HCl, 34 combined, 61 total.

SUMMARY.—Total devascularization of stomach in five dogs resulted in death of four. In the one that survived it would seem that at least one major vessel was not ligated.

With regard to evaluating the readings obtained from the various test meals I feel that only the first three series of dogs can be considered since the fourth series all came down with distemper soon after operation and had to be sacrificed, and in the fifth series all (except the one) died so promptly from gangrene of the stomach that practically no tests could be made.

In order to determine as far as possible the average reading on the normal dog in our laboratory living under the usual conditions of the institution, food and all, we gave seventy-one Ewald test meals to fourteen different animals and got an average reading for the total of 5 free HCl, 36 combined, 41 total.

If we compared to this the average reading (forty-four tests) of the three dogs of Series 1, where the lesser curvature was either partially or totally devascularized—6 free HCl, 46 combined, 52 total—we find a distinct increase. The second series of three dogs where the lesser and greater curvatures were partially devascularized shows from twenty tests an average reading almost the same as the normal—5 free HCl, 34 combined, 39 total, to 5 free HCl, 36 combined, 41 total.

The third series of three dogs, where the lesser curvature was totally and the greater curvature partially devascularized, shows from forty-eight tests an average reading of 6 free HCl, 25 combined, 31 total, which is a definite decrease.

In each series, whatever difference there was was always in the *combined acids*, though in the individual animals wide discrepancies in the free HCl were noted.

The average for the ten dogs is 6 free HCl, 35 combined, 41 total, which is almost exactly that of the normal.

From these eighteen experiments the following conclusions with regard to the physical aspects of the situation can be drawn:

(1) The stomach (of the dog) can withstand any amount of diminution of its blood supply, whether on the lesser or the greater curvature or on both, short of total devascularization.

(2) The animal either recovers or does not recover. In other words, there is no middle ground where he lives and ekes out a miserable existence.

(3) This being the case, the collateral (compensatory) circulation of the organ must be not only most extensive but most active and effective.

(4) Ligation of blood-vessels does not give rise to ulcers—certainly not macroscopical ones.

(5) Where total devascularization is done, it is the greater curvature that becomes gangrenous, the lesser being unaffected.

From the standpoint of effect on secretion the only definite conclusion that can be reached is that thus far nothing approaching an anacidity was found. In this connection it may be said that no conscious attempt was made to deal with the sympathetic nerve fibres going to the stomach, though it is obvious that many of them must have been cut.

In certain animals and in certain groups there seemed to be a slight decrease of acidity but much more work will have to be done in order to be certain about it. In view of the extensive devascularization that was carried out in some of the animals it was most surprising to note that if they lived their stomach went right on pouring out acid much as if nothing had happened. In a way, this, too, is much like what happens following polar ligations in the thyroid gland. There comes to pass a diminution of activity of greater or lesser degree, sometimes rather temporary, sometimes permanent, but it is rare that one can accomplish as much by ligation as by excision.

Just how far the analogy between the stomach and the thyroid can be carried out is a question—one has an idea that, quite aside from the vascular, the nervous mechanism of the two also is much alike—but in any case the comparison is intriguing and may be productive of interesting results. In hyperfunction of the thyroid one can and does excise the major part of the gland, not only with impunity but with great good to the patient. Unfortunately, one cannot remove the stomach with equally happy results—despite the reports of certain enthusiasts. So at that point certainly the analogy will have to cease. Even so—in fact, just because of it—studies of the effects of devascularization of the stomach require further investigation. Many angles of the problem have not even been touched upon here.

This paper is submitted as a preliminary report.

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## THE VAGUS NERVE AND ITS RELATION TO PEPTIC ULCER

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NO FIELD of medicine has received more attention from investigators than the relation of peptic ulcer to the neuro-motor and neuro-secretory mechanism of the stomach. The result has been that very few statements have gone unchallenged and most investigations have thrown new shadows into an already clouded picture. The complexity of the literature signifies that we are dealing with a very intricate and difficult problem and only after repeated corroboration of experimental facts can the physiological principles be established.

It is interesting to note the methods which have been employed to produce peptic ulcer: (1) Lesions of the central nervous system. (2) Lesions of the vagus. (3) Lesions of the splanchnic nerves. (4) Direct trauma to the stomach. (5) By local embolic circulatory disturbances. (6) By the ingestion of bacteria. (7) By intravenous injection of bacterial toxins. (8) By injection of adrenalin, silver nitrate, *etc.*, into the walls of the stomach. (9) By intravenous injections of poisons and autolytic toxins. (10) By cutaneous burns. (11) By establishing a pyloric insufficiency and the injection of trypsin. (12) By removal of the adrenal glands.

At many times several methods have been combined. This is particularly true for the production of chronic ulcer. However, no method or combination of methods consistently produces chronic peptic ulcer. With the ease of production of acute ulcer and the difficulty of production of chronic ulcer, there is suggested that the problem divides itself into two phases. The first phase concerns the cause of the initial or acute ulcer and the second phase deals with the chronicity of the lesion. Is the same factor behind the acute and chronic ulcer, except perhaps in a different degree, or does another factor or group of factors enter into the problem of chronic ulcer? As yet, investigators have not been able to answer this question although experimental evidence favors a secondary factor. Friedman and Hamburger<sup>1</sup> produced gastric ulcer by injection of 5 per cent. silver nitrate under the mucosa. These ulcers healed rather rapidly unless the pylorus was partially obstructed, causing retention of gastric secretions. They assumed that an acute ulcer causes spasm and then the retention results in hypersecretion and hyperacidity. This experiment with delayed healing of the ulcer and the deductions which follow would be of more value if the ulcer had caused the pyloric spasm and

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retention rather than the operative production of partial pyloric obstruction. Morton<sup>2</sup> produced acute gastric ulcer by excision of the mucosa and then found that by surgical duodenal drainage whereby the alkaline duodenal contents were not able to influence the gastric acidity and the continuity of the gastro-intestinal tube had been reestablished by anastomoses of the jejunum of the pylorus, that there was delayed healing of the gastric ulcers. This experiment also lends some support to the view that a secondary factor is necessary in establishing chronicity but the experiment is certainly atypical of the normal anatomical physiological relations and merely suggests that the alkaline duodenal secretions aid in healing. Other investigators have produced chronicity of ulcers by introducing a secondary factor but it has been impossible to produce chronic ulcer consistently by means of any method in which the normal anatomical relations of the stomach, pylorus and duodenum have been retained.

A number of investigators have observed lesions of the vagus and medulla oblongata in reporting autopsies of cases with peptic ulcer and have attempted to link this pathology with the ulcer problem. Singer<sup>3</sup> found peptic ulcers frequently enough in pulmonary tuberculosis cases where mediastinal involvement was marked to lead him to believe that the vagi nerves had been affected, resulting in stomach ulceration. He also reported cases of meningitis and vagi nuclear changes coincident with peptic ulceration. He also reported cases of vagus neuritis in lead poisoning, where peptic ulceration had been found. Schiff<sup>4</sup> observed hæmorrhagic infiltration and ulcerations following intersection operation of the thalamus and cerebral peduncles. Oberling and Kallo<sup>5</sup> claim to have produced peptic ulcer following experimental lesions of various central gray nuclei. Durante,<sup>6</sup> repeating the work of Vedova Dalla,<sup>7</sup> produced acute and chronic ulcers by section of the splanchnic nerves. Gundelfinger<sup>8</sup> after extirpation of the celiac ganglion succeeded in producing gastric lesions. Latzel,<sup>9</sup> on the contrary, as well as other observers, has reported negative results after extirpation of the celiac ganglion. Finzi<sup>10</sup> and later Keppich,<sup>11</sup> among others, have reported atrophic ulceration following resection of the vagus. According to Greggio,<sup>12</sup> Donati, Martini and others described negative results following vagotomy in the neck of rabbits and Krehl, Butsch, Fiosi, Lilla and others reported negative results following vagotomy in the thorax and abdomen. Alvarez,<sup>13</sup> in the course of some experiments pertaining to bowel motility, observed gastric ulcers in a rather large percentage of rabbits following bilateral vagotomy. As regards changes of the nerves in the stomach wall, Okkel,<sup>14</sup> after carefully examining a large number of stomachs with gastric ulcers, reported there was usually present considerable perineuritis of the nerves adjacent to the ulcer and he considered these changes secondary, but believed they may contribute to the chronicity of ulcers.

The vagus nerve has also been extensively studied regarding its control of the motility, tonus and secretions of the stomach. All of these factors are thought to have some bearing upon the ulcer problem. As in the above-cited

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experiments, the investigations have not been uniform. However, we believe one of the most fundamental pieces of work was carried out by McSwiney and Wadge<sup>15</sup> whose results in general are practically accepted. According to them, stimulation of the vagus, regardless of the intensity of frequency, produces inhibition when the tonus is high and contraction when the tonus is low. This suggests a certain degree of autonomy of the stomach wall and is supported by the work of Alvarez in his study of the irritability and rhythmicity of the stomach and intestine after section of the vagi and splanchnics. Alvarez concludes that the gastro-intestinal tube possesses a large degree of autonomy and the neuro-muscular mechanism responsible for orderly diastalsis must be looked for in the bowel itself. Kuntz<sup>16</sup> further established the conception of an intrinsic reflex arc in the wall of the gastro-intestinal tube when he demonstrated a complete arc between Auerbach's and Meissener's plexuses in the cat. Although these investigations practically give conclusive evidence of the autonomy of the stomach wall, there has been no evidence set forth that the stomach is not under the influence of the sympathetic or parasympathetic systems under certain conditions, a factor that must not be forgotten in an investigative or clinical study of peptic ulcer.

A study of the effect of bilateral vagotomy on the emptying time of the stomach would appear to be a rather simple experiment. Yet, very carefully planned and controlled experiments have produced diametrically opposed results. Table I presents this conflicting evidence. An analysis of this work shows that the majority of writers have observed an increase in the emptying time of the stomach after vagi section. After very careful observations,

TABLE I  
*Emptying time of stomach following bilateral vagotomy*

Author	Emptying time		Remarks
	Initial	Total	
Cannon <sup>25</sup>	Increase		
Koennecke <sup>26</sup>	Increase	Increase	
Latarjet <sup>27</sup>	Increase		
Litthauer <sup>28</sup>	No change	Increase	
Nieder <sup>29</sup>	Possible slight increase		
Stierlin <sup>30</sup>	Slight increase	Slight increase	
Watanabe <sup>31</sup>	Early slight increase	Increase	
Hughson	Marked decrease		
McSwiney, McCrea and Stopford	Marked decrease	Within normal limits	Some animals showed slight increase and others showed slight decrease

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Hughson<sup>17</sup> reports a definite decrease in the emptying time. McCrea, McSwiney and Stopford<sup>18</sup> report only a decrease in the initial emptying time. They observed slight variations in the total emptying time ranging from a slight increase to a slight decrease. It is very difficult to account for these variations and evaluate the procedure for clinical surgery.

The results of vagi section on gastric secretion have varied. That the psychic phase of secretion is permanently and entirely abolished has been proven by Pavlov and confirmed by Farrell<sup>19</sup> and others. The influence of the bilateral vagotomy on the gastric phase of secretion has given varied results. Hartzell<sup>20</sup> in his experiments upon dogs puts forth evidence that there is a reduction in both free and total acidity. The work of Lim, Ivy and McCarthy<sup>21</sup> is certainly convincing evidence that the stomach or a pouch completely deprived of vagi innervation responds to both mechanical and chemical stimulation. The clinical results by surgeons who have experimented with vagi section on the human have not been uniform although some encouraging results cannot be denied. This work of Lim, Ivy and McCarthy further supports the conception of the intrinsic nerve reflex and that the true control of gastric motility and secretion is in the stomach wall, yet does not deny the directive influence of the extrinsic nerves.

All of these experiments and observations suggest the possibility that an ulcer having appeared on the mucous membrane either by direct trauma or by temporary disturbance of the neuro-motor or neuro-secretory mechanism of the stomach, the development of chronicity depends upon some trophic element such as a lesion of the central nervous system, the vagi nerves, the sympathetic nerves or a local disturbance of Auerbach's and Meissner's plexuses.

Heineke,<sup>22</sup> Pigalew and Buschmakina<sup>23</sup> and later Manenkov<sup>24</sup> performed some very interesting experiments on rabbits with production of peritonitis followed by section of the vagi. If the vagi were cut and some weeks later a peritonitis was established by injection of bacteria, an animal with bilateral vagotomy lived much longer or even survived the infection whereas the control rabbits all died within nine to twelve hours. Manenkov further proved that a local severe inflammation of the stomach wall of a rabbit was always fatal while the production of local peritonitis in organs such as the large intestine, uterus, etc., which are not directly associated with the vagus, did not give fatal results.

This latter series of experiments suggested to us that possibly the presence of a neuro-lymphatic connection between the stomach, vagi nerves and medulla might explain the chronicity of certain lesions of the stomach. It was assumed that a primary traumatic ulceration or inflammation beginning in the stomach wall would result in pathological changes of the vagi nerves or various nuclei in the medulla oblongata. Therefore, the following experiments were performed in the hopes that such a pathological relationship could be established.

The stomach walls of ten rabbits were injected with a suspension of *staphylococcus aureus* and after death an autopsy performed and sections

taken from the medulla, cervical vagi, thoracic vagi and stomach for microscopic examination. Sections were taken from the sciatic nerves to serve as control nerve tissue. The amount of injected material was slightly varied on several occasions. The life of the animals varied from sixteen to forty-eight hours. Below is the description of a typical experiment:

Full grown rabbit. Laparotomy performed and 2 cubic centimetres of a 1/100, twenty-four-hour old staphylococcus aureus culture in normal saline injected under the serosa of the anterior wall of the stomach near the lesser curvature. Eighteen hours later the animal died. At post-mortem examination there was no evidence of general peritonitis. There was a marked inflammation of the stomach wall at the site of injection, an area about 1½ centimetres in diameter. Under this area and somewhat more extensive, the mucosa was injected and numerous small, dark, discolored areas were found. Some of these showed early ulceration. The medulla oblongata, segments of cervical and thoracic vagi, segments of the sciatic nerves and a portion of the stomach were removed for microscopic examination.

It would be only repetition to give the protocols of the remaining nine rabbits, since the course of the infection was the same in every experiment except for the degree of reaction and later death that occurred in the animals receiving the lesser amount of staphylococcus culture. It was remarkable how innocent the infection on the stomach wall appeared, and yet all of the animals died within forty-eight hours. There was no attempt made to repeat the experiments of Manenkow to prove whether or not section of the vagi prolonged life, since the object of our own experiments was to demonstrate pathological changes in the vagi nerve or central nuclei, which might account for chronicity of lesions of the stomach wall.

Serial sections were made from the medulla of each rabbit. There were no definite consistent pathological changes found. A few sections showed some very minor pathological changes, such as slight vacuolation, slight tyngolysis or a slight decrease in the clearness and sharpness of the nerve-cell body outlines. These changes are probably not significant in view of their indefiniteness and inconsistency. Also in the few sections that did show these changes, there were minor and indefinite changes in the vagi and sciatic nerves of the same rabbit. Both longitudinal and cross sections of the vagi and sciatic nerves were studied. There were no definite constant changes demonstrable. Occasionally there was found a slight swelling of an axis cylinder.

The sections of the stomach showed varying degrees of inflammation with or without ulceration and with or without abscess formation. There was no definite relationship between the degree of inflammation of the stomach wall and the degree of slight changes in the nervous tissue. In other words, severe inflammation of the stomach wall did not necessarily indicate greater changes in the vagi nerves or medulla without corresponding changes in the sciatic nerves. The slight nerve pathology which was seen could be explained easily on a general toxic basis.

With these negative findings which showed absence of definite lesions in the medulla oblongata and vagi nerves following definite inflammatory changes



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of the stomach wall which were sufficient to cause death, it is rather difficult to assume that acute lesions of the stomach wall produce changes in the vagi or medulla oblongata which would result in chronicity of an initial lesion such as gastric ulcer.

Since we were unable to establish a pathological relationship between the vagi nerves, vagi nuclei and stomach with the primary lesion in the stomach, we concluded that the next procedure was to produce a chronic irritation of the vagus and note the pathological changes that might occur in the stomach.

Ten dogs were used in this set of experiments. In the first two animals, the experiments were carried out in the following manner: A blind pyloric pouch was made by sectioning the duodenum just beyond the pylorus and closing both ends of the duodenum. The stomach was then sectioned about two inches proximal to the pylorus. The pyloric portion was sutured to the skin, giving a blind pyloric pouch and fistula. The fundic end of the stomach was then anastomosed to the side of the descending portion of the duodenum. After allowing about two months for complete healing to take place, both vagi in the neck were exposed and about two inches of magnesium strips were wrapped around the nerves and the wound closed tightly. Both of these dogs died on the fourth day after operation. The autopsy findings were negative, not only as regards the examination of stomach, duodenum and pyloric pouch, but also as regards the cause of death. We attributed the cause of death to the vagus inhibitive action upon the heart. To further substantiate this hypothesis and also to help establish the fact that we were actually irritating the vagi, magnesium was wrapped around the vagi nerves of two dogs without a previous stomach operation. As expected, both dogs died on the fourth day. It was then apparent that we must either put magnesium only upon one nerve in the neck or upon both vagi in the region of the diaphragm. We assumed it better to use one vagus in the neck because the branches of the vagi are rather small and delicate in the region of the diaphragm. Also, there existed the possibility that the magnesium might act as a direct irritant on the stomach wall and thus defeat the purpose of the experiment. Strips of magnesium were then wrapped around the right or left vagus of six dogs. At periods varying from one month to four months after the vagus operation, the abdomen was opened and the stomach and duodenum were carefully examined. No ulcer of the stomach or of the duodenum was found in any case. At this time in each animal, a pyloric pouch with a fistula was made and the proximal section of the stomach sutured to the side of the duodenum. This type of operation offered the opportunity for direct examination of the mucous membrane surfaces of a pyloric pouch at repeated intervals. None of these animals showed evidence of acute or chronic gastric or duodenal ulcer. The animals died or were killed in periods ranging from one month to six months after this second operation. The pyloric pouch, the stomach and the duodenum were closely examined and particular attention was given to suture lines. There was found no evidence of an acute or chronic gastric or duodenal ulcer and no delay was observed in the healing process along the former suture lines.

Summarizing these experiments, we have attempted to produce definite changes in the vagi nerves or medulla oblongata by a rather active inflammation in the wall of the stomach, hoping that such pathological changes could be proven later to be a factor in the chronicity of peptic ulcer. Definite and consistent changes were not demonstrable. Since these findings were negative it was believed that the experiment would not be complete until it was proven that a known irritant of the vagi nerves, such as magnesium strips, would or would not produce acute or chronic gastric or duodenal ulcer.

Rather long-drawn-out experiments of this nature did not result in peptic ulceration of the stomach or duodenum or delay the process of healing.

*Conclusions.*—(1) The results are rather convincing that lesions of the stomach do not result in organic changes of the vagi and medulla through a direct neuro-lymphatic connection.

(2) Direct continued irritation of the vagus with a known irritant such as magnesium does not produce acute or chronic gastric or duodenal ulcer and does not prolong healing.

(3) This is supportive evidence that section of the vagi nerves for the treatment of peptic ulcer will prove to be of little value.

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## RECURRENT PERFORATION OF PEPTIC ULCERS

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THE recurrence of an acute perforation of a duodenal ulcer in one of my patients led to the following questions. How frequently does this accident occur? Could any form of treatment have been used at the first operation that would have prevented the second perforation? Standard works on the subject were consulted but failed to give an answer to these questions. A partial review of the literature was made. The reports of 4,813 cases of perforated peptic ulcer were studied. A brief résumé of the data collected is here presented.

**CASE REPORT.**\*—E. N., No. 35,279, a forty-five-year-old white railroad foreman, was admitted to the hospital May 24, 1930, with a complaint of severe upper abdominal pain of fourteen hours' duration.

**Present Illness.**—For the past fifteen years the patient has had intermittent periods of epigastric distress coming on two hours after meals, associated with gaseous eructation, burning and nausea. This has been relieved by food, soda or enemata. There have been no vomiting or hæmatemesis. Three months before admission he had a bilateral herniotomy done in Cleveland without alteration in digestive symptoms.

Twenty-four hours before admission he was given a barium breakfast for gastrointestinal roöntgenograms. He remained in the physician's office the greater part of the day for study. He was told that the X-rays showed "a ptotic dilated stomach with a filling defect typical of ulcer."

At seven that evening he was suddenly seized with a severe epigastric pain which was sharp and tearing in character and did not radiate. The pain was associated with vomiting and prostration. He was brought to the hospital at 9:35 A.M., fourteen and one-half hours after the onset of symptoms.

**Physical Examination.**—Temperature, 38.2°; pulse, 96; respirations, 34; blood-pressure, 138/100.

The patient was in evident distress. He held himself immobile, had a drawn, anxious expression, was sweating and breathed with shallow rapid respirations. The general physical examination was negative. The abdomen showed retraction below the costal margin with generalized board-like rigidity. There was exquisite tenderness with rebound tenderness over the entire abdomen slightly more marked in the right upper quadrant. Shifting intra-abdominal fluid could not be demonstrated. The liver dullness was not obliterated. Rectal examination showed generalized pelvic tenderness.

**Laboratory Findings.**—Hæmoglobin, 98 per cent.; red blood-cells, 4,330,000; white blood-cells, 25,400. **Urine.**—Dark yellow. Specific gravity, 1026; sugar, 0; albumin, heavy trace. **Mic.**—Many granular casts with occasional white blood-cells.

**Impression.**—Perforated peptic ulcer.

**Operation.**—At 10:35 A.M., fifteen and one-half hours after perforation, under ether anaesthesia, the abdomen was opened through an upper right rectus incision. As soon as the peritoneum was incised, turbid fluid welled out of the wound. A culture was

\* This patient was referred to the clinic through the courtesy of Dr. Harold Trott, of Hemlock, New York.

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taken. The peritoneum was everywhere reddened and covered with fibrin. There was a perforation one-half inch in diameter on the anterior surface of the duodenum just beyond the pylorus. The opening was closed with through-and-through silk sutures; a second row of inverting mattress sutures was placed above this. Exudate and food particles were carefully aspirated from the abdomen. Because of the long interval between perforation and operation, a drain was placed in the pelvis and brought out through a stab wound in the right lower quadrant. The upper abdominal incision was closed in layers with a small rubber tissue drain to the subcutaneous tissues. The patient stood the operation well and left the table in fair condition.

*Post-operative Course.*—The patient was given 500 cubic centimetres, 10 per cent. glucose by vein and 2,000 cubic centimetres normal saline by hyperdermoclysis on his return to his room. For the first two post-operative days fluids were supplied by subcutaneous administration. Fluids by mouth were taken on the third day and soft solids on the sixth post-operative day. The rectus incision healed by first intention. The stab wound drained profusely for seven days, then closed and healed. The culture taken at operation showed no growth. The patient's general condition being satisfactory and his wounds well-healed, he was allowed up on his fourteenth post-operative day and was discharged on a modified diet three days later.

*Final Diagnosis.*—Perforated duodenal ulcer.

*Second Admission.*—The patient was readmitted October 1, 1931. He stated that he had been perfectly well for more than year after his previous operation. Consequently he had not adhered to the diet prescribed. In July, over two months before admission, he had had a return of epigastric distress with eructations and burning coming on about two hours after meals. He consulted his physician, who prescribed a modified diet and powders. This gave some relief.

On the day of admission at 12:30 P.M. he had a sudden severe epigastric pain just to the right of the mid-line. The pain continued and he entered the hospital four and three-quarter hours after its onset.

*Physical Examination.*—Temperature, 36.4; pulse, 88; respiration, 26. Blood-pressure, 128/78. The findings were similar to those at his previous admission. A diagnosis of recurrent perforated duodenal ulcer was made and operation advised.

*Operation.*—Under ether anaesthesia, the abdomen was opened through a paramedian incision. The peritoneal cavity contained many adhesions which when freed allowed escape of a large quantity of food, turbid fluid and gas. The stomach was greatly distended, the pylorus was fibrosed and constricted. Just beyond the pylorus, on the anterior surface of the duodenum, was a perforation one-quarter inch in diameter. This perforation was in exactly the same location as the previous one. The perforation was closed with a double layer of mattress sutures of silk. Since a definite organic pyloric stenosis existed and since the patient's condition was favorable, a posterior gastroenterostomy was done.

The patient had a satisfactory convalescence until his fourteenth post-operative day. At this time he had a right-sided pulmonary infarct. He was just recovering from the effects of this when, six days later, he had a second infarct. Subsequently a bronchopneumonia developed in the right lung. Blood cultures showed no growth. Repeated examinations revealed no evidence of subdiaphragmatic or subhepatic abscess. The temperature remained elevated for sixteen days. At the end of this time it returned to normal. The lung signs cleared. He was allowed out of bed on his forty-third post-operative day and discharged in good condition forty-nine days after operation.

*Final Diagnosis.*—Recurrent perforation duodenal ulcer; pulmonary infarcts (multiple); bronchopneumonia, right.

*Incidence of Recurrent Perforation of Peptic Ulcer.*—The reports of 4,813 cases of perforated peptic ulcer were examined and thirty-three instances of recurrent perforation were found. This gives an incidence of



0.69 per cent. of recurrent perforation in perforated ulcer. This figure may be a little low since some authors did not mention recurrent perforation. Instances of it may have occurred which were not recorded.

*Can any procedure be used at the time of the first operation which will prevent subsequent perforations?*—In its essentials this question is reduced to that of the end-results of surgical management of acute perforated ulcer. For, if ulcers recur after surgical treatment for perforation, then that recurrence renders them liable to re-perforation.

It is desirable, then, to summarize the data related to the results of operative treatment of perforated peptic ulcer. The factors influencing the immediate mortality are:

(1) *Age*.—Very young and very old patients do not withstand the ordeal of perforation as well as do those in the middle groups of life. On the other hand, 71 per cent. of perforations occur between the ages of twenty and fifty years, so that in the majority of patients age is not a conditioning factor.

(2) *The general condition of the patient*.—The presence of cachexia, anaemia, cardiovascular or nephritic lesions or debilitating diseases such as tuberculosis may render the individual incapable of surviving the perforation.

(3) *Character of the lesion*.—The perforation of gastric ulcers results in a higher mortality than does that of duodenal ulcers. Large perforations are more serious than small openings.

(4) *Interval between perforation and operation*.—The elapsed time is the most important of any of the conditioning factors. The mortality has been repeatedly shown to be directly proportional to the interval before operation. The surgeon is powerless to overcome the handicap of a delayed operation. The greatest responsibility rests in the hands of the physicians who first see the patient. The statistics of Dineen well illustrate the importance of early operation.

Ninety-four cases operated upon under six hours, mortality 7 per cent.

Thirty-two cases operated upon between six to twenty-two hours, mortality, 31 per cent.

Sixteen cases operated upon after twenty-two hours, mortality 81 per cent.

The aforesaid factors influence the mortality prior to operation. There is nearly universal agreement as to their importance. No such united opinion exists among surgeons as to relative merits of different operative procedures. There is only one positive indication that is agreed upon by all. The opening in the bowel must be closed. When this is not done the mortality is very high. The incomplete procedures which have been attempted include (a) simple drainage; (b) packing or tamponade of perforation with drainage; (c) jejunostomy with drainage; (d) gastrostomy or enterostomy by a tube inserted in the perforation.

These halfway measures fail to meet the one clear-cut indication of operation. They do not close the hole in the bowel.

Aside from the agreement on this principle of closure there is a wide divergence of opinion as to what constitutes the operation of choice for per-

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forated peptic ulcer. Each procedure has its advocates. The operations used are: (a) Simple closure of the perforation; (b) excision of the ulcer with closure; (c) excision of the ulcer with pyloroplasty; (d) closure of the perforation with gastroenterostomy; (e) excision of the ulcer with subtotal gastrectomy. For the first two it would seem immaterial whether the ulcer was excised or closed so long as a tight approximation was obtained. The addition of pyloroplasty to the excision would appear on theoretical grounds to be an ideal procedure. It eliminates the perforated ulcer and at the same time creates a more physiological safeguard against recurrence. In our experience it has not fulfilled expectations and has given poor end-results. Hinton has recorded the same observation.

The use of subtotal gastrectomy for the treatment of acute perforated ulcers has been advocated by European surgeons. Granting that gastric resection is often valuable in the treatment of gastric ulcer, it would appear illogical to use it in the presence of a perforation. To do so subjects an already handicapped patient to an extensive major operation. It has not been accepted in this country.

The greatest field of debate has been between the advocates of simple suture and suture plus gastroenterostomy. Guthrie attempted by a questionnaire to find out the consensus of opinion on this topic. One hundred fifty-two answers were received from prominent surgeons throughout the country. Three used pyloroplasty. Of the remainder, twenty-two (14 per cent.) did a gastroenterostomy as a routine, sixty-four (42.1 per cent.) never did a routine gastroenterostomy at the time of perforation, and sixty-three (41.3 per cent.) occasionally added gastroenterostomy to closure of the perforation. It would seem that the correct solution rested with the latter group. In the great majority of instances simple closure of the perforation is sufficient. There are occasional cases where gastroenterostomy is indicated irrespective of the perforation. The statistics reviewed show clearly that the added manipulation of a gastroenterostomy is well tolerated by a robust patient operated upon within twelve hours of perforation. Hence, if there is reason to do the procedure, such as for organic pyloric stenosis, and if the condition of the patient is favorable, there appears to be no contraindication to it. The treatment indicated for the perforation is its closure, that for the pyloric stenosis is gastric drainage with a gastroenterostomy. If the two can, with impunity, be combined at one operation, then it would appear logical to do so. This is entirely different from the proposition that gastroenterostomy should be used routinely in the treatment of perforated ulcers. Such a thesis has little factual basis.

*Recurrent Perforation.*—These data on acute perforated peptic ulcers give a basis for consideration of their recurrent perforation.

*Mortality.*—In the group of thirty-three cases of reperforation there were three deaths. The cause of death in one of these cases (Gibson<sup>22</sup>) is given as the "result of psychosis." This gives a mortality rate of 9 per cent. However, these thirty-three cases represent a total of seventy-five acute perfora-

tions. Thus the mortality per perforation is 4 per cent. while for perforated ulcers in general it is 27 per cent. Apparently once a patient survives acute perforation of an ulcer he is less apt to die from subsequent perforations. Some factors contributing to this result are:

(1) The presence of adhesions which may limit the extravasated material to localized pockets rather than permitting dissemination through the peritoneal cavity.

(2) The possible increase in the local tissue immunity of the peritoneum from the previous inflammation.

(3) Perhaps most important is the fact that the patient has had this experience before, he makes his own diagnosis, and presents himself for treatment early.

*The Influence of Previous Surgical Treatment on the Incidence of Reperforation.*—Recurrent perforation of an ulcer is merely one manifestation of recurrent ulceration. As such its incidence should correlate with that of recurrent ulcer after surgical treatment of a perforation. However, in the cases studied there were no instances of reperforation following the use of pyloroplasty or subtotal gastrectomy. These procedures were used in only about 6 per cent. of cases, so this fact is interpreted to lack of data rather than to the prophylactic properties of these operations. Both, when used for non-perforating ulcer, lead to instances of recurrent ulceration. If they should be used extensively for treating the acute perforation of ulcers, then occasional cases of recurrent ulceration would be expected and these in turn would be liable to reperforation.

Johnson found that in 1,056 cases of perforated ulcer, 710 (67.2 per cent.) were treated by suture, 281 (26.6 per cent.) by suture and gastroenterostomy and sixty-five (6.2 per cent.) by all other methods. In the thirty-three cases of reperforation, twenty-four (72.7 per cent.) were treated by suture, eight (24.3 per cent.) had an added gastroenterostomy, and in one (3 per cent.) the method was not stated. It is seen that the percentage of reperforation after these surgical procedures approximates the respective incidence of their use.

There is one additional fact worthy of note. In only one of the twenty-four cases of reperforation after suture was there a total of more than two perforations. This one case had three acute perforations. In the eight cases following an original suture and gastroenterostomy there were five cases who reperforated three or more times. In three of these a jejunal ulcer was responsible. It is ironical to note that one of the cases was originally operated upon by Deaver,<sup>12</sup> formerly the foremost advocate of routine gastroenterostomy in the treatment of acute perforated ulcers. Following his original operation, this patient survived two subsequent perforations that were treated by suture. It would seem, therefore, that the recurrent perforations after gastroenterostomy are more apt to be multiple and hence of more serious consequence. Two of the three deaths in the series occurred among the eight patients who had had a primary gastroenterostomy.

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### SUMMARY

(1) A case of recurrent perforation of a duodenal ulcer is recorded.

(2) The reports of 4,183 cases of perforated peptic ulcer were examined and thirty-three instances of reperforation were found. This gives an incidence of 0.69 per cent., or an average of one case in 145 cases of acute perforated ulcer.

(3) In the group of thirty-three recurrent perforations, there were three deaths, a mortality of 9 per cent. The group represents a total of seventy-five acute perforations, so that the mortality per perforation is 4 per cent. This is much lower than that for acute perforated ulcers in general, which have an average mortality rate of 27 per cent.

(4) In the thirty-three cases of reperforation, twenty-four (72.7 per cent.) were originally treated by simple closure, eight (24.3 per cent.) had an added gastroenterostomy, and in one (3 per cent.) the method was not stated. This correlates with the statistics for the management of acute perforated peptic ulcers which shows 67.2 per cent. treated by simple closure, 26.6 per cent. by closure and gastroenterostomy and 6.2 per cent. by all other methods.

(5) Only one of the twenty-four cases of reperforation treated by suture had more than two acute perforations. Of the eight patients who had a primary gastroenterostomy, five perforated three or more times. A jejunal ulcer was responsible in three of these cases. Two of the three deaths in the series of reperforation occurred in this group which had had a primary gastroenterostomy.

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\* These authors report cases of recurrent perforation.

## RESECTION OF THE FUNDUS OF THE STOMACH FOR PEPTIC ULCER

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THE evolution of the surgical treatment of peptic ulcer shows a gradual development from gastrojejunostomy, pyloroplastics, local excision or destruction, duodenal resection, pylorotomy and partial gastrectomy to subtotal gastrectomy.

Because of the unsatisfactory results, removal of the "ulcer-bearing area" has been gradually enlarged upon, extended toward the cardia with removal of more and more of the fundus.

Because of repeated recurrences after extensive removal of the fundus it has been recommended that the gastro-intestinal continuity be reestablished by gastro- (or fundus) duodenostomy, instead of the usual gastro-jejunal anastomosis. This union of the fundus and the duodenum seems to be looked upon as the important factor, while another, possibly the more important factor, *i.e.*, removal of additional acid-secreting mucous membrane—in effect a partial fundusectomy—has not been emphasized.

A new principle has been suggested in which the ulcer is allowed to remain and an attempt is made to counteract, or remove, a supposed cause—the hydrochloric acid—by removal of the fundus. This allows retention of the normal antro-pyloro-duodeno neuromuscular mechanism, instead of the formation of an artificial, unnatural and incompetent fundus-duodeno reunion.

With removal of equal amounts of acid-secreting fundus, and in one case sacrifice of, and in another retention of, this normal acid base regulatory structure at the pylorus, it seems reasonable to expect more favorable results in the latter.

If removal of the fundus—the acid-secreting portion of the gastric wall—is to be carried out, it seems logical to do so as a first, rather than a late step, thereby possibly eliminating one or more unnecessary operative procedures.

Fundusectomy fulfills satisfactorily the three requirements of the surgical treatment of early duodenal ulcer as outlined by Balfour,<sup>1</sup> *viz.*, insignificant risk, with good prospect of permanent cure, and does not interfere with future surgical treatment, if ulcer develops subsequently.

Theoretically,<sup>2</sup> experimentally<sup>3</sup> and clinically such a procedure is practicable in selected cases of either primary or secondary ulcer.

The report of a clinical case follows:

CASE I.—H. P., referred by Dr. T. D. Smith, of Neenah, Wisconsin. Aged twenty-four years, male, married, mill worker by occupation. Father died of carcinoma of

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the stomach. Mother: Living, has "gall-stones." Sister: One, gastroenterostomy for "ulcer of stomach." Brother: One, gastroenterostomy for "perforation of ulcer of the stomach"; one has "ulcer of stomach."

*Past History.*—"Rheumatism" ever since a child. During 1916 and 1917, was invalided for about one year. In 1926, a severe attack of acute rheumatism, which was followed by a tonsillectomy.

*Present History.*—Sudden onset of "indigestion" in March, 1928, characterized by gas, epigastric discomfort, nausea, belching, rarely regurgitation and still more rarely vomiting, occurring a few hours after eating and at night. Relieved by food or soda. Occasionally, there is a rather severe cramp-like pain, definitely localized in epigastrium or right hypochondrium which does not radiate. The above complaint is constant and similar every day. Constipation is of long standing, there is no qualitative food distress. Appetite is good, with no weight loss and no jaundice. Patient continued at work on a milk diet and soda with continuation of symptoms. In May, 1928, at 10 A.M., while at work, he experienced severe abdominal pain with collapse. He was taken to Theda Clark Memorial Hospital where a diagnosis of acute perforation of gastric ulcer was followed by closure of the perforation and a gastrojejunostomy. Recovery was prompt and satisfactory.

The patient remained symptom-free until July, 1929, when dietary indiscretion was followed by a return of gastric symptoms, distress and discomfort, no pain, with characteristic food ease, for which he was again placed upon a "diet and soda" and continued at his work.

In August, 1929, sudden nausea, distress, gas, weakness, syncope, pallor, palpitation, vomiting of blood and melena. There was no abdominal pain. The patient was placed in the hospital for treatment. The laboratory findings revealed: Blood, hemoglobin, 53 per cent.; red blood-cells, 3,570,000; white blood-cells, 13,600. Urine, albumin and casts. Pulse, 150. Blood-pressure, 90/60.

A few days later there was high temperature with acute pains in arms, legs, hips and neck, with an acute endocarditis. The treatment consisted of "salicylates and alkalies" with milk and cream diet. This was followed by prompt relief of arthritic and cardiac symptoms and he soon left the hospital, but with continued gastric distress.

In September, 1929, X-ray examination was made which demonstrated that the stoma of the gastroenterostomy was patent and that the duodenum was not normally visualized.

Distress one and one-half to two hours after eating, with relief by food or soda; symptoms exactly the same as before operation, continued through October.

In November, 1929, abdominal tenderness at umbilicus was complained of; melena, but no vomiting, with secondary anemia continued. The gastric symptoms with gradually increasing weakness in December, 1929, forced re-hospitalization. A second laparotomy was performed January 6, 1930. The old ulcer was found to have healed, with no crater, induration, stippling or obstruction at the duodenum; but at the stoma there was a pea-sized induration with stippling of the serosa. This ulcer was excised, the gastroenterostomy "taken down" and the openings in the stomach and the jejunum were closed.

February 6, 1930, the patient was discharged from the hospital upon a diet with no gastric complaint. He remained fairly comfortable with occasional days in which there was complaint of gas, distress and fullness, usually after dietary indiscretion. Such spells occurred with increasing frequency until in August, 1931, his symptoms were practically the same as before the first operation; distress and food ease with increasing pain in upper right abdomen and in epigastrium, with weight loss, from 180 pounds to 155 pounds, high gastric acidity, with no hematemesis or melena. In September, 1931, X-ray examination revealed pylorus deformed, but functioning, with no ten-hour retention.

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Symptoms continued despite rest and medical management. December 14, 1931, operation for recurrent duodenal ulcer, a third laparotomy with fundusectomy, was carried out.

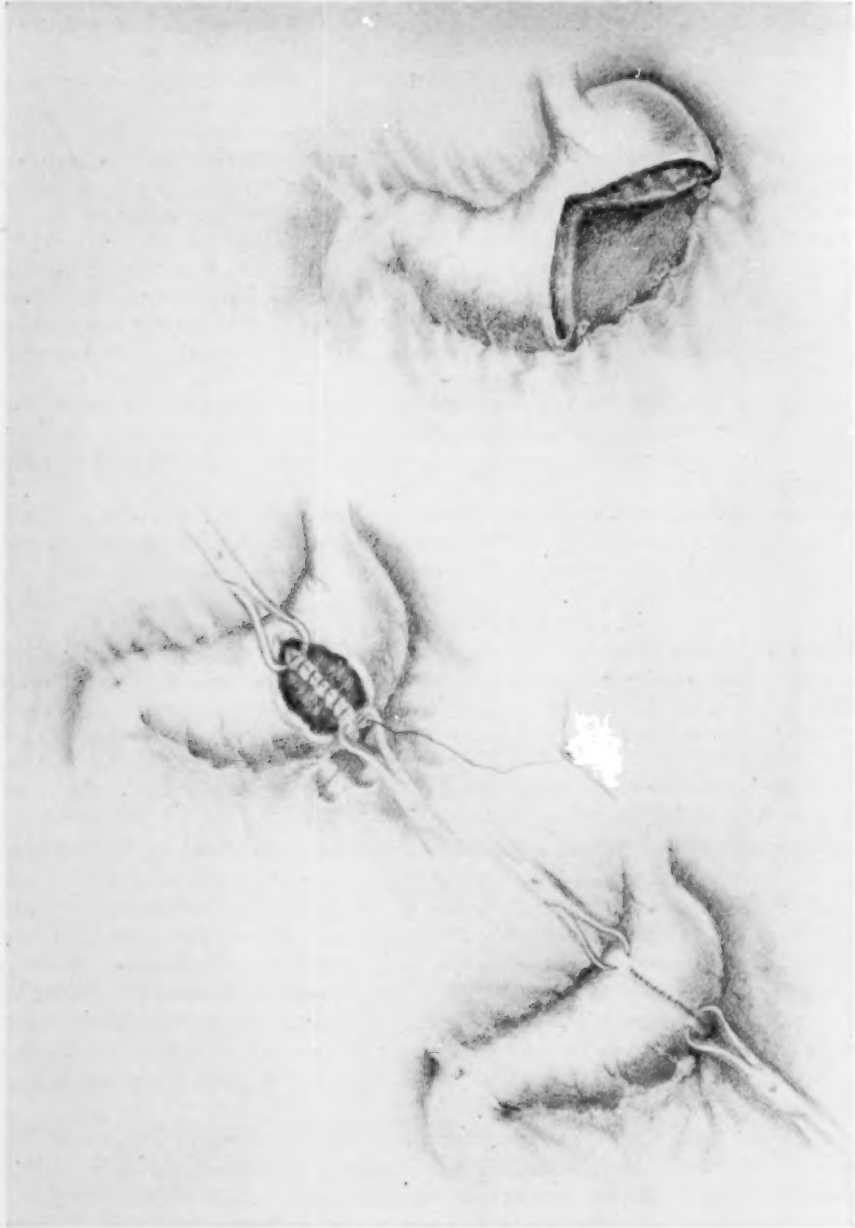


FIG. 1.—Resection fundus of stomach in treatment of peptic ulcer.

The immediate post-operative result was entirely satisfactory. The man left the hospital on the twenty-first day and, to date, has been symptom-free, but the well-known irregularities and remissions in the natural course of peptic ulcer necessitate considera-

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tion of many cases and the elapse of ample time before results may be intelligently discussed or properly evaluated.

The technic of fundusectomy is simple. After opening the abdomen, careful exploration of the abdominal viscera allows confirmation of the previous diagnosis of a patent pylorus. Delivery of the stomach (and stoma in cases in which the jejunum is still attached) is followed by division of the greater omentum between doubly ligated vessels, for the distance that the greater curvature is to be removed—about the middle half—after which the peritoneal cavities may be carefully "walled off."

From the chosen points, on the greater curvature, the anterior and posterior walls are divided—the incisions extending obliquely upward and meeting about one inch below the lesser curvature—in this way removing a triangular fragment of stomach fundus, with approximately half of the greater curvature as its base, with anterior and posterior walls meeting at a point just below the lesser curvature, which is retained intact. (Fig. 1.)

By grasping, with forceps, the posterior wall at the upper limit of the incision, and the greater curvature at each line of incision, the divided posterior stomach wall will be held in suitable apposition and position for hemostasis and suture.

The reconstruction is made with one, or two, layers of chromic catgut; beginning at the upper extremity on the mucous surface and extending to the greater curvature. The upper extremity of the united posterior wall is then released and the upper extremity of the as yet ununited anterior wall is grasped by forceps, which, with the forceps remaining at the greater curvature, hold the anterior wall in suitable position for over-and-over continuation of the suture (before completing the closure the gastric, pyloric or duodenal lumen may be carefully examined). The omentum is now attached to the reconstructed greater curvature and the abdomen closed without drainage.

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## PEPTIC ULCER IN INFANTS UNDER ONE YEAR OF AGE

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GASTRIC and duodenal ulcers in infants under one year of age are not so rare as they were formerly supposed to be. The former condition is less frequently encountered than the latter, but the literature is by no means scanty in case reports of both.

Reading the literature for the purpose of gathering data on gastric and duodenal ulcer in infants under one year of age leaves much to be desired. The information regarding age, sex, and diet of infants dying of ulcer is very meagre. Moynihan, for example, Second Edition, 1912, gives sixteen case reports of various authors. Of these, four were female, two male, and in ten the sex was not stated. Many reports giving the case history and autopsy findings will state that the patient was a child, and leave one totally in the dark as to whether the child was a year or six years of age. Very few reports give any indication regarding the diet, and one cannot know whether the infant in question nursed or was fed a formula.

One must exercise care not to confuse true ulceration in infants with superficial necrosis or intestinal decomposition. These latter conditions are prone to occur very soon after death. Unless the area suspected has a definite punched-out appearance with sharp edges, one should hesitate to include the case with those of true ulceration.

The first recorded case is that reported in 1825 by Siebold.<sup>1</sup> It was a perforation of a gastric ulcer in an infant two days old. Hecker and Buhl,<sup>2</sup> in 1864, reported the first case of duodenal ulcer. Spiegelberg<sup>3</sup> reports death from perforation of duodenal ulcers in two infants five and twenty-four hours old, respectively.

Since then the literature is sprinkled with numerous reports of ulcers discovered accidentally in doing a routine autopsy following death due to other causes; or from death due to hæmorrhage or perforation of an ulcer. Rarely is the condition diagnosed previous to operation or death.

Holt<sup>4</sup> states that in 1800 post-mortem examinations made at The Babies Hospital, 90 per cent. in children under one year of age, ulcer was found only four times—.222 per cent. He does not specify whether these are gastric or duodenal. Compared with most other reports, this is a very low percentage. Schmidt,<sup>5</sup> for example, in his exhaustive monograph, reports ulcer in 1.8 per cent. of cases in 1,109 autopsies performed on children under one year of age. This is eight times the percentage reported by Holt. Both articles were published the same year.

Schmidt makes the further statement, and quotes figures to prove it, that duodenal ulcer is more frequently encountered during the first year of life than at any other time. This is certainly contrary to the general belief.

Sturtevant and Shapiro,<sup>6</sup> reporting results on 7,700 autopsies at Bellevue Hospital, found gastric ulcer in five children under one year of age. This is of little statistical value for the autopsies were on individuals of all ages.

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Veeder<sup>7</sup> reports having seen five cases of duodenal ulcer in infants under one year of age. These were at the St. Louis Children's Hospital. He calls attention to the fact that this condition, when it does occur, is most frequent in the first four months of life.

Butka<sup>8</sup> says: "Although the literature abounds in reports of duodenal ulcer, the occurrence of gastric ulcer in infants is exceedingly rare. Careful search has revealed only three cases of ruptured gastric ulcer in infants under two months of age." This may be an accurate statement in so far as American authors are concerned. As will be shown later in this paper, there are many such cases on record.

Helmholz,<sup>9</sup> in 1909, reported nine cases of duodenal ulcer in infants under four months and an additional report of seven cases seven months or under. Four of the latter group had two or more ulcers.

Multiple ulceration either in the stomach or duodenum is not infrequently reported. These may be of the kissing variety, or sufficiently removed from each other and so placed that contact could play no part in their occurrence. As many as five separate and distinct ulcers have been found in the same infant.

Numerous other authors, including Thoms,<sup>10</sup> Kobes,<sup>11</sup> Palmer,<sup>12</sup> Billard,<sup>13</sup> Schwab and Le Bourlier,<sup>14</sup> Somerford,<sup>15</sup> and Stern, Perkins and Nessa,<sup>16</sup> report numerous cases of both gastric and duodenal ulceration.

Rogers<sup>17</sup> reports two cases of duodenal ulceration in the same family—one appearing at seven weeks, and the other at two months. The first case had three separate and distinct ulcers.

Nixon and Fraser<sup>18</sup> report several cases of ulceration at the cardiac end of the stomach. In one case the ulceration completely surrounded the œsophagus. This must be an unusually rare condition, as I find no further reference to it in the literature.

The classic monograph of Theile<sup>19</sup> includes ulceration in children up to sixteen years of age. Extracting those cases that fall within the age limit of this paper, we find case reports on 137 ulcers. Of these there were: gastric, 51; duodenal, 78; location not stated, 5; multiple, 3. His figures show that the greatest number occur during the first few days of life and that perforation is more frequent in gastric than in duodenal cases.

It seems fair to assume that many cases of melena neonatorum have an ulcer basis. Some of these patients recover and a diagnosis is never made. Others die and no autopsy is performed. One has no way to determine the number of ulcers that pass undiagnosed.

In the stomach these ulcers are generally, though not necessarily, situated on or near the lesser curvature. In the duodenum they are practically always on the posterior wall, nearer the papilla than the pylorus.

I shall here add three unreported cases of gastric ulcer:

CASE I.—Patient of Dr. Adolph G. De Sanctis. Female, aged two months, eleven days. Discharged April 12, 1931, for respiratory infection. Re-admitted April 20, 1931, bilateral swelling ear drums. Operation April 20, 1931, bilateral myringotomy. Blood transfusion. Died April 21, 1931, at 5.45 A.M. Autopsy at 9.30 A.M. Inspissation pneumonia; double otitis media. Gastro-intestinal tract—stomach: at the lesser curvature near the pyloric sphincter there were two areas of necrosis surrounded by a zone of marked congestion, each measuring about thirty millimetres in diameter. The two areas merged into one another, and on further dissection revealed two areas of perforation most probably due to handling of this necrotic tissue. The rest of the gastro-intestinal tract was negative. Pancreas negative. Sections of the stomach wall taken around the ulcer revealed marked œdema and extensive polymorphonuclear cell and eosinophilic infiltration of the entire thickness of the wall. There was a large amount of purulent exudation on its outer surface. The mucosa of the stomach wall was gangrenous and exfoliated over the ulcerated area. The tissue beyond the ulcer was

congested and œdematous. The entire ulcerated area and the injected area around the periphery of the ulcer was also extensively infiltrated by a fungus made up of branching filaments and quite a large number of spores. Further discussion with the pathologist revealed the fact that sprue was probably the basis of the ulcers. Microscopical examination.—Diagnosis—inspissation pneumonia; acute gangrenous ulcers of stomach, showing the presence of a large number of segmented, branching, spore-bearing filaments; encephalitis. *Final Diagnosis*.—Bronchopneumonia; acute double otitis media; acute ulcers of stomach.

CASE II.—Patient of Dr. Harold Denman Meeker. Male, aged three months. History.—In spite of every effort, patient vomited persistently for about three weeks prior to operation. There had been great difficulty in feeding him since birth. At operation an ulcer about a centimetre and a half from the pyloric sphincter was found on the anterior surface close to the greater curvature. There had been a perforation, but the opening had been walled off by adherent omentum. A simple closing of the ulcer margins was done, using fine chromic gut, reinforcing the surface by stitching omentum over the peritoneum and then doing a posterior gastrojejunostomy, the surgeon feeling at the time that this operation could be done more rapidly and with less shock than a pyloric operation. Patient made an excellent recovery.

CASE III.—Patient of Dr. Marshall C. Pease. Male, eleven months old. History.—Vomited feedings for several days; this was followed by vomiting of blood; melena; rapid collapse, and death. Autopsy performed within one hour after death showed a perforated ulcer on the anterior surface of the stomach close to the lesser curvature.

With such facts before us, it seems fair to assume that duodenal ulcer in infants under one year of age is certainly not a rarity. Furthermore, with new cases of gastric ulcer constantly being reported, it is reasonable to conclude that this condition occurs much more frequently than is generally supposed.

Like peptic ulcer in the adult, it is, in infants, probably due to a combination of conditions. Anything that lowers general resistance certainly predisposes to whatever the active agent may be. Holt<sup>4</sup> says: "In sixty-five cases in which the age is given, 70 per cent. occur between the sixth week and the fifth month. This corresponds closely with the age incidence in death from marasmus." Theile<sup>19</sup> stresses the point that a majority of the cases reported by him had one of the numerous constitutional diseases such as marasmus, tuberculosis, syphilis, uræmia, etc. Helmholz<sup>20</sup> says: "They have some connection with antecedent wasting illness, for such enfeebled infants more rapidly develop ulcer." Moynihan<sup>21</sup> says: "In poorly nourished, atrophic infants, ulcer is probably very frequently present."

Thus the normally delicate structures of the infant, having been further enfeebled by some wasting disease, fall an easy prey to a variety of infectious organisms. The work of Saunders,<sup>22</sup> while it does not refer to ulcers in infants, is applicable and most illuminating. Rosenow,<sup>23</sup> as well as Gerdine and Helmholz,<sup>24</sup> report clinical and experimental evidence supporting the infectious nature of ulcer. More recently, Kennedy<sup>25</sup> has isolated a streptococcus from ulcer. He also finds streptococci and other bacteria in the ulcer tissue but none in the tissues surrounding the ulcer.

Most of the authors quoted herein, particularly Schmidt,<sup>5</sup> emphasize local thrombosis as a frequent cause. There is no doubt that the thrombus will

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cause ulceration, but we must go one step beyond this and relate the cause of the thrombosis.

Traumatism, either in normal or difficult delivery, must be considered as an important factor in the causation of ulcer. Such injury would certainly reduce the resistance of a normal or already enfeebled membrane. It would be prone to slow up the circulation or cause ecchymosis or even thrombosis. The tissues are then an easy prey to bacterial attack. If the condition can take place in tissue hardened to resist trauma, it must certainly occur frequently in the sensitive internal membrane of the enfeebled infant.

The fact that all such ulcers show a complete absence of round-cell infiltration and all other evidence of inflammatory reaction, in other words, that there is only evidence of destruction, none of repair, is no argument against the bacterial theory. There must be present at least normal resistance to stimulate round-cell infiltration and the other reactions to bacterial invasion. These factors are not present in the type of infant most likely to be affected with ulcer.

Unfortunately, the condition is practically never suspected or diagnosed until hæmorrhage or perforation occurs. It is then practically always too late to help. One of the three cases reported in this paper was diagnosed previous to operation by Doctor Meeker, and the result was a happy one. This is the youngest case reported of a successful operation for a perforated gastric ulcer.

Until blood appears, most often in the stool but not infrequently in the vomitus, there is practically no definite sign or symptom upon which an accurate diagnosis can be made. Abt's "Pediatrics," p. 535, quoting Holt, says: "Perforation and hæmorrhage are exceedingly rare." I think the numerous reports herein will successfully refute such a statement. Vomiting or the spitting up of sour fluid is so frequent that one would certainly not suspect ulcer unless there were other more damaging evidence. Realizing, however, that ulceration is frequently found in infants, persistent vomiting should make one suspicious that he may be dealing with an organic lesion. Occasionally symptoms of pyloric obstruction are noted in connection with some hæmorrhage. This should give a clue to the diagnosis, and has been elaborated upon by Finny<sup>26</sup> and Helmholtz,<sup>9</sup> quoting Birk. When, after persistent vomiting with or without blood, plus active melena, there is a sudden collapse, one can be assured that the underlying condition is in all probability peptic ulcer. Even at autopsy the condition is likely to be overlooked, for the ulcer may be very small and obscured by blood or fibrin.

If ulcer is suspected, one can safely resort to the X-ray, which should certainly be regarded as being the best ally in making a diagnosis. I find only two references to the utilization of this method—Stern, Perkins and Nessa,<sup>16</sup> and C. Pedrazzi.<sup>27</sup> The first-mentioned authors give a complete case history of a two-day old infant. By means of a catheter, sufficient barium was instilled into the stomach to permit hourly X-ray exposures. The report showed a niche on the lesser curvature near the pylorus.

Little is reported in the matter of treatment. Apparently little need be said. Surgery certainly holds the only hope of a cure. Even with surgery the outlook is none too brilliant. Unless the diagnosis has been made early and surgery resorted to before perforation or massive hæmorrhage has taken place, the prognosis is indeed gloomy. The case reported in this paper operated upon by Doctor Meeker is certainly the exception that, one might say, proves the rule. Repair of the perforation or suturing the ulcer, with arrest of the hæmorrhage done as quickly as possible, offers the best hope for a live patient. In older children, according to Henderson,<sup>28</sup> medical treatment is the method of choice.

#### SUMMARY

(1) Duodenal and gastric ulcer—particularly gastric—in infants under one year of age occur much more frequently than is generally supposed, at least in 1.8 per cent. of cases. With more autopsies and a closer inspection of the viscera involved, this percentage would undoubtedly be greatly increased.

(2) They practically always occur in infants who have some constitutional disease—particularly marasmus. Traumatism and infection are perhaps secondary causes.

(3) Except in rare cases, the diagnosis is never made until perforation or persistent and massive hæmorrhage occurs.

(4) The treatment is early surgical interference.

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## PARTIAL GASTRECTOMY FOR LYMPHOSARCOMA IN CHILDHOOD \*

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ALTHOUGH formidable surgical procedures in childhood are no longer unusual, one seldom sees a lesion in early childhood where a radical partial gastrectomy is indicated. Lymphosarcoma of the stomach is usually encountered in adult life, in which cases the operability of the lesion is perhaps higher than in cases of carcinoma of the stomach. The literature contains less than 400 cases of lymphosarcoma of the stomach found surgically and at autopsy. The earliest age at which lymphosarcoma of the stomach was ever encountered was in the case of a boy three and one-half years of age, reported by Finlayson,<sup>5</sup> in 1899. In this instance, the diagnosis was made at autopsy. The case which I am reporting is presented because of the rarity of the lesion in childhood, and because it was discovered in the youngest child on record where a partial gastrectomy has been done for lymphosarcoma of the stomach with subsequent recovery of the patient. \*

THE CASE.—A boy, aged three years and eight months, was brought to St. Vincent's Hospital March 16, 1931. The boy had been perfectly well until three weeks previously, when he began vomiting. X-ray examination soon after onset of the vomiting showed pyloric obstruction, with dilatation of the stomach and hyperperistalsis. General examination of the child was negative, except for visible epigastric peristalsis. Twelve days prior to admission to the hospital, a mass became palpable in the upper abdomen. The vomiting had become projectile in type. There had been a weight loss of but four pounds.

He was a somewhat emaciated, dehydrated, and hollow-eyed child. A large dilated stomach, in which active peristalsis was visible, could be outlined. A mass about three centimetres in diameter was palpable at the pylorus, and a number of nodules could be palpated across the median line to the left, at about the greater curvature of the stomach. The physical examination was otherwise negative. Except for a trace of albumin, the urine was normal. The hæmoglobin was 70 per cent.; erythrocytes numbered 4,460,000; leucocytes, 7,350; lymphocytes, 76 per cent.; large mononuclears, 3 per cent.; and neutrophils, 18 per cent. March 18, 1931, exploration revealed a firm, rather diffuse lesion encircling the pylorus and involving the pyloric third of the posterior wall of the stomach. (Fig. 1.) There were a number of glands less than one centimetre in diameter along the greater curvature of the stomach, several of which were removed and proved to be inflammatory. A general abdominal exploration disclosed no extragastric involvement. A gastric resection was done, and the pyloric half of the stomach was removed, after which a posterior Polya type of anastomosis was made. The child's convalescence was most satisfactory and he was dismissed from the hospital on the fifteenth day after the operation. Subsequent X-ray therapy was carried out.

Pathological report of Doctor E. M. Hall: "Specimen consists of a tumor of the pyloric end of the stomach. It measures ten by five by two centimetres. The growth is cuneate in shape, with the base involving the entire pyloric sphincter. The proximal part extends tongue-like for seven centimetres, along the greater curvature and posterior wall

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of the stomach. The growth is somewhat nodular, with smooth rounded edges. It appears to be covered with mucous membrane except for a small area near the proximal end, where there is a punched-out ulcer seven by ten millimetres in diameter and ten millimetres deep. The tumor varies from five millimetres to 2.5 centimetres in thickness. At the pylorus it is two centimetres thick. The tumor has a pale grayish-yellow color on its cut surface and is somewhat yellow on its external surface. The tumor stops sharply at the pylorus. Some of the solitary follicles in the duodenum are prominent.

"Sections of the tumor show an extremely cellular growth composed of diffuse cellular connective-tissue stroma, surrounding large atypical cells of lymphoid type. These are probably reticular cells of lymphoid tissue. Numerous mitoses are present. The growth is covered by atrophic mucous membrane, while the muscularis is almost destroyed by the



FIG. 1.—Photograph of pyloric half of the stomach containing lymphosarcoma, completely encircling the pylorus and involving the posterior wall of the stomach.

infiltrating tumor. Section of the lymph-nodes shows hyperplasia and hypertrophy of the follicles. They contain no tumor-cells. *Diagnosis*.—Lymphosarcoma of the stomach (pylorus)."

*Comment*.—The high percentage of lymphocytes in the differential count is of unknown significance. It is of interest that on the eighth day post-operatively the percentage of lymphocytes had decreased to 62 per cent., while the neutrophils had increased to 37 per cent. August 8, 1931, or nearly five months after the operation, a further reduction in lymphocytes to 43 per cent. had occurred, with an increase in neutrophils to 51 per cent. In August, the patient had some slight gastric disturbance. However, a physical examination of the child was negative, and an X-ray examination of the stomach by Dr. K. S. Davis<sup>1</sup> showed that the stomach emptied readily, and there was no

röntgenological evidence of recurrence. November 27, 1931, more than eight months after the operation, the boy was reported to me to be in good health.

*Incidence of Sarcoma of the Stomach.*—Less than 400 cases of sarcoma of the stomach are recorded in the literature. It has been estimated that sarcoma accounts for about 1 per cent. of the malignant lesions of the stomach. Bruch reported the first case in 1847; in 1914, Forni compiled a list of 200 cases from the literature. In 1920, Haggard<sup>7</sup> collected 244 authentic cases of primary sarcoma of the stomach from the literature, 107 of which had been operated upon. In 1930, D'Aunoy and Zoeller<sup>4</sup> reported four cases, and collected from the literature through 1929 cases seen since those compiled by Forni, to make a total of 335. In 1930, Balfour and McCann<sup>2</sup> reported fifty-four cases from The Mayo Clinic, which, when the proper deductions are made of cases previously reported—twelve cases by Haggard, and five cases by Broders and

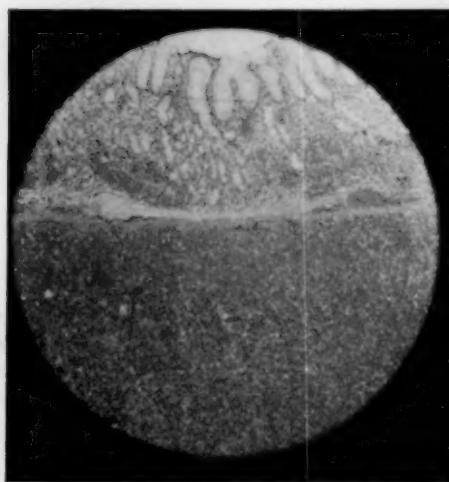


FIG. 2.—Low-power photomicrograph of lymphosarcoma of the stomach shown in Fig. 1.

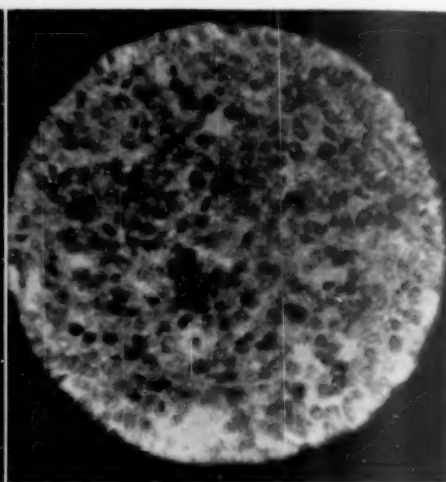


FIG. 3.—High-power photomicrograph of lymphosarcoma of the stomach shown in Fig. 1.

Mahle—add thirty-seven cases to those collected by D'Aunoy and Zoeller. Nine cases have been reported since that time by Schiff and Foulger<sup>9</sup> (one), Coffey<sup>3</sup> (one), Askey, Hall and Davis<sup>1</sup> (one), Reeves<sup>8</sup> (two), and Gatewood<sup>6</sup> (four). There are recorded in the literature approximately 381 cases of sarcoma of the stomach. For the most part this material has been adequately analyzed by Forni, D'Aunoy and Zoeller, Haggard, Balfour and McCann, and Askey, and careful deductions and conclusions have been recorded.

A diagnosis of sarcoma of the stomach is seldom made pre-operatively, and an exploration is usually done after a diagnosis of carcinoma of the stomach, tumor of the stomach, or abdominal tumor has been made. There is nothing characteristic of sarcoma to assist in making such a pre-operative diagnosis with any degree of certainty. Usually, the diagnosis is made only on section and microscopical study. Pathologists may experience considerable difficulty in determining the type of sarcoma and differentiating the lesion

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from Hodgkin's disease or isolated lymphogranulomatosis of the stomach. Singer<sup>10</sup> recently reported a case of the latter, with a discussion of only seven other similar cases in the literature.

Practically all types of sarcoma occur in the stomach. However, lymphosarcoma is encountered most frequently. Lymphosarcoma accounted for 22 per cent. of the cases of sarcoma of the stomach studied by Haggard; 39 per cent. of the cases reviewed by D'Aunoy and Zoeller were lymphosarcoma, and this type of sarcoma was present in 59 per cent. of the cases reported by Balfour and McCann.

It is of interest that sarcoma of the stomach occurs earlier in life than carcinoma. The average age of patients with sarcoma of the stomach reported in the literature is about forty-one years, as compared with an average age of sixty-one years in patients with carcinoma of the stomach. The oldest patient, reported by di Giacoma, was ninety-one years of age, and the youngest, reported by Finlayson, was three and one-half years of age. While sarcoma of the stomach may occur in relatively young adults, approximately only 5 per cent. of the cases reported have been patients under twenty years of age, and in most instances when the disease has occurred in the second decade of life it has been after the fifteenth year. A review of the literature reveals extreme rarity of sarcoma of the stomach in the first decade of life. Unfortunately, the age had not always been included in the case reports. It has been possible to find recorded but two cases of patients less than ten years of age. D'Aunoy and Zoeller included but one patient under ten years of age and that was a child of eight years reported by Demel in 1924. The youngest patient in the series reported by Balfour and McCann was ten years of age. In 1899, Finlayson reported a case of sarcoma of the stomach in a boy three and one-half years of age, the youngest child on record. At that time, the author stated he had been unable to find records of any definite case of sarcoma of the stomach in a young child.

In general, the operability of sarcomatous lesions of the stomach is probably greater than in instances of carcinoma. Balfour and McCann reported an operability of 66 per cent. in their series. In the series of cases studied by D'Aunoy and Zoeller, excluding the cases therein reported from The Mayo Clinic by Haggard, and those by Broders and Mahle, which are included in the series of Balfour and McCann, it is noted in the cases in which details are included that seventy-six cases were subjected to exploration, with surgical removal by some type of gastric resection or excision in sixty-three cases, an operability of 82 per cent., with a surgical mortality rate, however, within thirty days of approximately 14 per cent. The prognosis in cases of sarcoma of the stomach seems to be somewhat more favorable than that in cases of carcinoma of the stomach. In many instances, this is due to pedunculation of the lesion. Certain types of sarcoma are not infiltrating in type but have sharp demarcation and definite limitation of involvement, which favors radical removal, with total exclusion of the lesion. Balfour and McCann report approximately 32 per cent. of the patients living after a period of years. The longest



duration of life in one case was nine years when last heard from. Haggard found approximately 64 per cent. of sixty-four cases collected from the literature where the patients were living and well after a period of years. The longest duration of time in one case was ten years. In 1921, Lendon reported a case of round-cell and spindle-cell sarcoma of the stomach where the patient was living and well eleven years after local excision of the lesion. Post-operative irradiation perhaps exerts some influence on the prognosis. Des Jardines has stated that lymphosarcomata are the most favorable of the sarcomata for Röntgen-ray treatment. The high percentage of operability and the relatively satisfactory results obtained through surgical removal of localized, definitely demarcated sarcomata of the stomach, gives encouragement to radical surgical endeavor in the treatment of sarcoma of the stomach.

**SUMMARY.**—A case of lymphosarcoma of the stomach in a child aged three years and eight months is presented, in which pyloric obstruction with projectile type of vomiting characterized the onset of symptoms. A partial gastrectomy, with a posterior Polya type of anastomosis, was made, with recovery of the child. After a careful search of the literature, it is believed that this case is the earliest age at which radical surgical removal of a sarcoma of the stomach has been recorded.

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## PSEUDOMYXOMA PERITONEI\*

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Two cases of pseudomyxoma peritonei in the male with a brief review of the disease are reported.

CASE I.—F. S., white male, aged forty-eight years, was admitted to the surgical service of the Lankenau Hospital August 13, 1930, complaining of abdominal pain. He states that twenty-four hours prior to admission he developed acute epigastric pain which was very severe. The pain improved during the night but next morning the pain was confined to the right lower quadrant. He took a physic which increased his pain. He had no nausea or vomiting, but he had no appetite. His general health was always good except for chronic constipation during the past several years. His temperature when admitted was 100 4/5; pulse 86 and respirations 18; a normal blood-pressure; normal haemoglobin and red cell count; a leucocytosis of 15,600 with 64 per cent. polymorphonuclears, 30 per cent. lymphocytes and 6 per cent. large mononuclears. The blood sugar and urea were normal. The abdomen revealed evidence of a mass in the right iliac fossa with overlying tenderness and rigidity. Peristalsis was diminished. The pre-operative diagnosis was appendiceal abscess. Operation done under spinocaine through a low right rectus incision revealed a palpable mass in the right iliac fossa, completely covered with great omentum. This area was well packed off with rubber dam and gauze pads. The omentum was then raised, revealing a large collection of whitish-yellow semi-gelatinous material. This was removed leaving a cavity, which could contain a large grapefruit. A short, thick, acutely inflamed appendix, which did not appear to be perforated, was removed from the centre of this cavity by transfixing the base and ligating. The caecum was found perforated at two points near the base of the appendix. These perforations were oversewn. Two large cigarette drains containing rubber tubes were placed in the cyst cavity and were surrounded with rubber dam. Incision was closed to drainage. The pathological report of the appendix was "chronic obliterating appendicitis with secondary columnar cell carcinoma in the lymphatics of the serosa." This patient developed a caecal fistula on the fifth post-operative day. He was discharged thirty-two days after operation. He was healed except for a small area of granulations in his scar. He has been perfectly well since leaving the hospital and is now employed as a hospital orderly.

CASE II.—A. M., white male, aged sixty-seven years, was admitted to the surgical service of the Lankenau Hospital September 2, 1930, with the chief complaint of abdominal distention. The only facts of importance in his history were: Several attacks of belching of brackish material two years ago, slight constipation and some frequency of urination during the past eighteen months. The abdominal mass was revealed over a year ago while undergoing a physical examination for rheumatic shoulders. He was X-rayed shortly after, revealing a mass in the right lower abdomen exerting considerable pressure on the caecum and terminal ileum and perhaps involving or arising from these structures. Operation at that time was decided against by his physician.

Upon admission to the hospital, his clinical analyses were within normal limits. Pre-operative diagnosis was mesenteric cyst. At operation September 6, 1930, under spinocaine anaesthesia, through a low right rectus incision, upon opening the peritoneum a large cyst was exposed occupying the entire lower abdomen and pelvis. The remainder

\* Read before the Philadelphia Academy of Surgery, January 4, 1932.

of the entire greater peritoneal cavity was involved by the pseudomucinous process. The cyst was attached in the right iliac fossa and the appendix could not be identified. About two litres of gelatinous material, amber in color, was removed from the cyst and about the same amount from the free peritoneal cavity. The abdomen was irrigated with normal saline in order to wash out more pseudomucin. Three large rubber tubes were inserted into the upper abdomen and held in place by catgut sutures. The cyst wall was partly closed and a perforated glass tube drain was placed in its lowest portion. The abdominal wall was closed loosely with long interrupted through-and-through heavy linen sutures and the wound packed loosely with gauze. On the fourth day post-operatively all drainage was removed and sutures tightened so as to close the wound tightly. The wound healed primarily and the sutures were removed on the twenty-second post-operative day. There were no complications. The patient was discharged twenty-six days after operation with an uneventful convalescence. The follow-up service reports that the patient is now enjoying good health. The only illness that he has had since operation was a spell of fever and jaundice lasting one month.

Pseudomyxoma peritonei, sometimes referred to as mucous ascites, is a comparatively rare disease occurring most often in women secondary to ruptured pseudomucinous ovarian cysts. It is more rare in the male, the above cases constituting the twelfth and thirteenth to have been reported in the literature. The term was originated by Werth in 1884, although Peon, in 1871, was probably referring to this disease when he described "myomatous degeneration of the peritoneum." Fraenkel, in 1901, was the first to report this disease in the male and to give a full description of it. Olshausen, in 1884, was the first one to publish the correct opinion as to the origin of pseudomyxoma peritonei. He believed it due to a transplantation of epithelial cells from ruptured cyst walls to the peritoneum.

Pseudomyxoma peritonei is clinically a fatal disease although pathologically it may be malignant or benign. Of all cases fully reported, about 62 per cent. were benign while the remaining 38 per cent. were malignant pathologically. It may originate secondary to ruptured pseudomucinous ovarian cystadenomas or from a ruptured mucocele of the veriform appendix. There have been cases reported in which the authors believed the condition to have originated in the gall-bladder, colonic appendages, great omentum or the omphalomesenteric duct. Pseudomyxoma peritonei has been produced experimentally in rabbits by ligating the appendix and cutting distal to the ligature.

The average age incidence of this disease is late in the fourth decade but it has occurred in patients ranging in age from eighteen to eighty-five years. The average duration of life after operation is between four and five years. One patient is reported living twelve years after operative diagnosis. Several cases have been reported to have had as many as five operations for the mechanical removal of pseudomucin.

The symptomatology of pseudomyxoma peritonei is varied. The only constant symptom is abdominal distention. In about 50 per cent. of the cases on record, abdominal pain was a symptom. Acute pain occurs in these cases only when due to an acute inflammatory process. As the pseudomucin increases, pressure symptoms arise such as constipation, dyspnoea, bearing-

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down sensations and frequency of urination. Several cases are on record having been correctly diagnosed before operation either by physical examination or paracentesis abdominæ.

In either case of primary source, the pseudomyxoma peritonei is caused by a transplantation and continued growth of low or high columnar cells cast off from the lining of the cyst or mucocele, as the case may be. The transplants may form multiple localized pseudomucinous cysts, a homogeneous, free-lying formation of pseudomucin or a combination of these processes. There is usually evidence of a marked attempt of the intra-abdominal organs to localize these processes by adhesions. Cases are on record in which these transplants are said to have perforated bowel and blood-vessels.

Death in the pathologically benign type of pseudomyxoma peritonei may be due to various causes such as: bowel perforation, perforation of large blood-vessels, obstructive pressure of various-sized cysts on hepatic ducts or other important organs, and cachexia. The pathologically malignant type excepting primary carcinoma of the appendix, causes death as does other intra-abdominal carcinoma.

The prognosis for patients who have pseudomyxoma peritonei, secondary to ruptured mucocele of the appendix, is better than in those secondary to ovarian cysts. Appendiceal mucocele occurs much more frequently in the male than in the female. These cases peculiarly reveal a leucocytosis of between 14,000 and 16,000 and are most often pre-operatively diagnosed as appendiceal abscess.

The chemical analysis of the gelatinous material removed from these cases is typically that of pseudomucin. It is sterile, containing a network of fibrinous material, and occasionally living cells with their processes. The chemical reaction of this material is acid when its origin is appendiceal, mucocele and alkaline when from ovarian cyst. The color may vary from a light amber, through cloudy dark amber to a dark cherry red.

The operative mortality in pseudomyxoma peritonei is due either to shock, pulmonary embolus or to peritonitis.

All cases should have deep radiotherapy following operation and they should not be drained unless otherwise indicated because of their extreme susceptibility to developing peritonitis.

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## CHRONIC OBSTRUCTION OF THE DUODENUM CAUSED BY ENLARGED RETROPERITONEAL GLANDS

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DUODENAL obstruction has received much attention during the last few years, many individual as well as series of cases having been reported. It is safe to say, however, that the etiological factor in many of the reported cases is still open to question and the part played by compression of the bowel by the mesenteric vessels has not been thoroughly evaluated in spite of the fact that this factor has been discussed frequently. Therefore, the following cases are reported because in each a definite obstruction of the duodenum was produced by a pathological process that has not been previously considered as of etiological significance.

The literature has been extensively reviewed by Kellogg. Rokitansky<sup>1</sup> was apparently the first to suggest that acute dilatation of the stomach could be produced by compression of the duodenum by the mesenteric vessels. Fagge<sup>2</sup> described the symptoms and post-mortem findings in 1873; one of his cases was due to a retroperitoneal abscess, probably arising from a perforated ulcer of the duodenum. Albrecht,<sup>3</sup> in 1899, reported two more cases and noted a flattening of the gut between the mesenteric vessels and the spine; this led him to experiment with traction on the mesentery and he concluded that obstruction could be produced in this manner. Conner<sup>4</sup> later did similar experiments on the cadaver and arrived at the same conclusion. Robinson,<sup>5</sup> Conner, Codman,<sup>6</sup> Kellogg,<sup>7</sup> and Higgins<sup>8</sup> have contributed excellent reviews of the subject, laying stress particularly on chronic ileus. Bloodgood,<sup>9</sup> Finney,<sup>10</sup> and others have discussed the subject in relation to acute dilatation of the stomach.

Practically all of the writers referred to have considered duodenal compression by the superior mesenteric vessels as an important etiological factor in both chronic duodenal ileus and in acute dilatation of the stomach; however, there have been dissenting voices, particularly those of Robertson<sup>11</sup> and of Devine.<sup>12</sup> The latter thinks a dysfunction of the neuromuscular mechanism is responsible in some cases, and Robertson rejects completely pressure by the mesentery as a cause. A classification of causes given by Higgins does not seem to be sufficiently comprehensive. If all the best-known theories and facts are included, they may be tabulated as follows:

- (1) Congenital anomalies.
- (2) Obstruction within the bowel (tumors, foreign bodies, constrictions).
- (3) Obstruction from without (abnormal masses, compression by mesenteric vessels).
- (4) Adhesions causing deformity and reduced motility.

(5) Neuromuscular dysfunction (toxic, Robertson; unknown origin, Devine).

In this communication we are interested primarily in the third group and particularly in the cases in which pressure from without is caused by abnormal masses. This has received scant attention but it occurs not uncommonly with pancreatic tumors, such as carcinoma arising in the head of the gland as well as with pancreatic cysts. Probably retroperitoneal tumors cause duodenal obstruction more often than is suspected, and that pressure may be exerted by neighboring neoplasms is well known. Recently Wantoch<sup>13</sup> has reported two patients with obstruction at the duodeno-jejunal junction caused by tuberculous glands. There is no mention of dilatation above this point, and treatment consisted in removing the glands.

I wish to report two cases of duodenal obstruction in the region of the mesenteric attachment produced by enlarged lymph-glands containing calcification due, presumably, to tuberculosis.

**CASE I.**—U-30,960. M. S., sixty years old, a white woman, was admitted to the hospital in May, 1930, complaining of "stomach trouble." The family history was negative for malignant disease, tuberculosis, and diseases of the blood. Her general health had been fairly good; in addition to the usual infections of childhood she had pneumonia at twelve years and influenza one year ago. There is also a history of malarial fever in childhood.

The present illness began one year ago when the patient began to have periods of nausea accompanied by occasional vomiting. These symptoms were not related to meals. The vomitus contained bile. She soon noticed anorexia, weakness, and fatigability, and three months ago the first actual pain occurred in the form of cramp-like pain in the epigastrium. Since that time attacks of pain have been frequent and often accompanied by a "rumbling noise" in the abdomen. Soda gives no relief. Recently her feet have felt cold and numb. There has been a loss of forty-five pounds in weight during the year.

**Examination.**—Temperature, 98.6°; pulse, 88. The patient is a poorly developed, thin woman who appears weak and anæmic. The skin and mucous membranes are pale but otherwise normal. No stomatitis. The abdomen is flat and symmetrical; on palpation definite rigidity is found in the epigastrium and some diffuse tenderness, especially toward the right. No abnormal masses can be felt. The entire abdomen is tympanitic but this is more noticeable in the epigastrium. The spleen is not palpable, and the general examination of heart and lungs as well as the neurological examination is negative.

**Laboratory Findings.**—Hæmoglobin, 57 per cent. White blood-cells, 6000. Red blood-cells, 4,100,000. Differential and smear show nothing except secondary anæmia. Wassermann negative. Stool is very light brown; contains bile but no occult blood. Gastric analysis after histamine shows free hydrochloric acid 0, total hydrochloric 15.

**X-rays with Barium Meal.**—Fluoroscopical examination showed a forty-eight-hour retention, pylorus slightly irregular, striking dilatation of duodenum. (Fig. 2.) The impression from a study of films was: Stomach normal, duodenum dilated, forty-eight-hour retention; these findings indicate a mass on the posterior wall of the stomach or a tumor in the region of the pancreas. **X-rays of the Chest.** Numerous calcified nodules in left apex, indicating an old tuberculous lesion.

**Operation** (Doctor Lewis, May, 1930).—The stomach was found somewhat dilated, but there was a greater dilatation of the duodenum. There was no evidence of ulcer. No obstruction could be found in the first and second portions of the duodenum, but

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at its junction with the jejunum a mass could be seen pushing up from behind the bowel, which was flattened over it. On palpation the mass was found to be nodular and partially calcified. It was the impression at the time that this represented enlarged glands, probably tuberculous in origin. An attempt to excise the mass in part or as a whole was considered inadvisable when it was found to be densely adherent over the vena cava and to the pancreas.

An anterior gastroduodenojejunostomy was done; the stoma began on the stomach, crossed the pylorus, and extended well into the duodenum. An entero-enterostomy was done then between the two loops of jejunum.

*Post-operative Course.*—The patient made a satisfactory recovery. Vomiting occurred only twice after the operation, and she was discharged twenty-two days later, relieved of her abdominal symptoms.



FIG. 1.



FIG. 2.

FIG. 1.—Case I. Showing calcification of the retroperitoneal glands.

FIG. 2.—Case I. Showing dilatation of the duodenum and retention of barium at the end of five hours.

*Subsequent Course.*—The patient was readmitted three weeks later complaining of weakness and numbness of the legs; there had been no recurrence of abdominal symptoms and she had gained weight. An extensive study was made, and in addition to the findings already noted, it was found that there were now slight sensory changes in the legs, and X-rays revealed some calcification in the retroperitoneal glands. (Fig. 1.) The administration of liver caused only a slight hæmatopoietic response. Her third admission was in June, 1931, when she returned to the medical service because of symptoms associated with anemia and occasional vomiting. X-rays showed that some dilatation of the duodenum persisted. The abdominal symptoms improved under symptomatic treatment.

In October, 1931, the patient returned again; weakness, anemia, and neurological signs persisted, and in addition vomiting had recurred recently. X-rays at that time showed dilatation of the duodenum and also of the proximal portion of the jejunum. A second operation was thought warranted.

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*Operation* (Doctor Lewis, October, 1931).—The nodular mass pressing up from behind the third part of the duodenum was evident; however, the arms of the jejunal loop appeared bound down to the mass, and there was little doubt that the existing obstruction resulted from this because the jejunal loops proximal to it were dilated. Another loop of small bowel was brought up and another gastroenterostomy and enteroenterostomy were done.

*Course*.—After operation she was greatly improved; she now has no gastro-intestinal symptoms and has gained 15 pounds in weight.

**CASE II.**—U-39,910. J. B., forty-nine years old. A white man who had had pain in the abdomen for five months. Both father and mother died of pneumonia. The patient's general health had been excellent prior to the present illness. He had the usual childhood diseases and scarlet fever at the age of fourteen. In 1914, an attack of

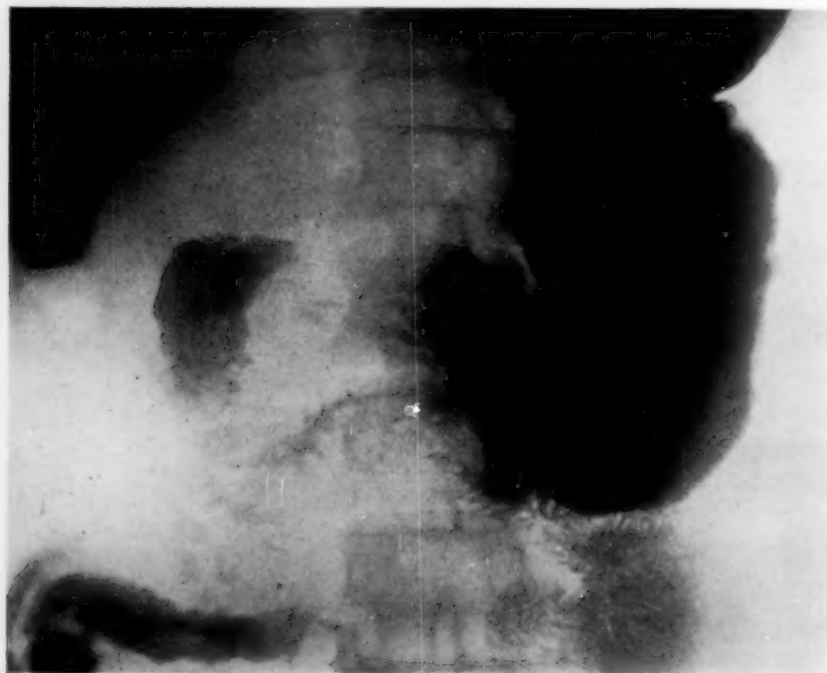


FIG. 3.—Case II. The barium is concentrated in the first portion of the duodenum and below it a partial obstruction exists.

abdominal pain, diagnosed appendicitis, incapacitated him for forty days. He was not operated on at that time. He had influenza in 1918. Five months prior to his admission to the hospital he began to have cramp-like abdominal pain coming on usually about fifteen to twenty minutes after eating. The pain began usually below the umbilicus and radiated to both flanks; there was frequent nausea but no vomiting at any time. His appetite is poor, and he has excluded articles of food from his diet so at present he takes practically nothing but toast and eggs. Six weeks ago an attack of diarrhoea lasted several days, and at that time the stools were light-colored. Lately the pain has become worse, and he has lost forty pounds since the onset of his symptoms.

*Examination*.—Temperature, 97.8°. Pulse, 80. The patient is a middle-aged man whose skin is of good color; he shows evidence of recent loss of weight. The general examination reveals nothing of interest except a moderate arteriosclerosis and some enlargement of the prostate. The abdomen is flat; there is no distension or asymmetry.

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The liver is not enlarged; half-way between the umbilicus and the right costal margin there is a tender area where an ill-defined, soft intra-abdominal mass can be felt, the edge of which cannot be outlined definitely.

*Laboratory Findings.*—White blood-cells, 8000. Hæmoglobin, 90 per cent. Stool clay-colored, negative for bile but positive for occult blood. Gastric analysis with histamine shows free hydrochloric acid of 24 and a total acidity of 52.

*X-rays.*—Fluoroscopical examination shows no obstruction at the pylorus; however, the duodenum is displaced, suggesting that it encircles a mass. The films show a partial obstruction, with dilatation; no lesion in the stomach. (Fig. 3.)

*Operation* (Doctor Lewis, October, 1931).—The first portion of the duodenum was considerably dilated because of an obstruction by a mass of calcified glands that almost surrounded the gut in this region. It was thought the process represented an old tuberculosis of the retroperitoneal lymph-glands. As the mass was densely adherent to the pancreas its removal was not attempted but a small piece was excised for section. An anterior gastroenterostomy was done in addition to an entero-enterostomy between the two arms of the jejunal loop.

*Pathological Report.*—The sections showed a calcified nodule surrounded by a capsule of fibrous tissue in which a chronic inflammatory cellular reaction was present. There was no other evidence of tuberculosis.

*Post-operative Course.*—The patient stood the operation well. The day after operation there was some vomiting and gastric lavage was resorted to; this was repeated, but when the vomiting stopped and only small amounts of fluid were obtained it was discontinued. On the third day the temperature rose to 102°, pulse 130, and the following day signs of pneumonia were present at both bases. The abdomen remained soft, but the patient became worse and died on the seventh day as the result of the pulmonary infection. Unfortunately, permission for autopsy was refused.

*Comment.*—The symptomatology of these cases presents nothing unusual. It is worthy of emphasis, however, that in both cases the obstruction of the duodenum and the accompanying dilatation did not extend below that portion of the digestive tube and in each instance the dilatation was marked and was diagnosed by X-ray before operation. Active tuberculosis could not be demonstrated elsewhere, but the glands involved contained extensive calcification.

The fact should not be overlooked that in Case I the actual mechanism of obstruction may be one similar to mesenteric ileus because the process may be interpreted as an instance in which the duodenum was pushed forward by the firm mass behind it and compressed between it and the mesenteric root. It has been suggested frequently that lordosis plays a similar rôle by narrowing the space between the spine and the mesenteric vessels, thus favoring compression of the bowel between them. In this case the obstruction was in the region of the vessels and the duodenum was "flattened over it." In the second case this factor can be excluded because the obstruction could be seen definitely at the junction of the first and second parts of the duodenum and was caused by the glands actually encroaching on the bowel.

The end-result of the first case was complicated by grave anæmia. The lymph-nodes appeared to have decreased in size in the interval between operations. The mass at the duodeno-jejunal angle had become calcified, maintaining the obstruction. The calcified mass can be seen in Fig. 1. The



arrow indicates the position. Death from pneumonia makes it impossible to draw conclusions as to the efficacy of operation in the second case.

SUMMARY.—Duodenal obstruction due to the presence of enlarged, calcified retroperitoneal glands has received little attention in the literature on this subject. Two such cases are reported. In both instances the obstruction and resulting dilatation were revealed by X-ray examination and confirmed at operation. Gastroduodenojejunostomy was done in one case and an anterior gastroenterostomy in the other. One patient developed a subsequent obstruction in the jejunum below the site of anastomosis which was due to adhesions between the gut and the glandular mass. Although the enlargement and calcification of the retroperitoneal glands were thought to be due to a tuberculous process, this was not confirmed by microscopical examination of the tissue removed or by the presence of active tuberculosis elsewhere. However, the presence of calcified pulmonary nodules in one case lends weight to this assumption.

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## GRAVITY FEEDING BY JEJUNOSTOMY

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JEJUNOSTOMY feeding has proved to be of great value in a variety of conditions that may be encountered in the surgery of the upper abdomen, such as gastrojejunal ulcer, malfunctioning gastroenterostomy, extensive carcinoma of the stomach, and in post-operative treatment of patients after gastric resection.<sup>2, 7, 8</sup> In cases of persistent biliary and external duodenal fistulæ jejunostomy feeding is sometimes a life-saving measure, since by this procedure the patient can be given a sufficient quantity of water, salt solution, and food, and also have restored the collected bile, pancreatic, and gastric secretions so essential to recovery.<sup>3, 4, 5, 6</sup> Under these circumstances, successful jejunostomy feeding requires the introduction of at least 2,000 cubic centimetres of fluid in twenty-four hours. By the method in common use, the frequent injection of small amounts with a syringe, this quantity of fluid cannot be introduced into the jejunum without disturbing the rest and comfort of these very sick patients, as is shown by a study of the cases in which the method was used at the Massachusetts General Hospital during the past twelve years. Pain and even reflex vomiting from distention of the loop of jejunum containing the catheter may be produced by the injection, so that at times patients have refused to allow the injections to be made. By the gravity method, on the other hand, large amounts of fluid, even up to ten litres per day, can be given with ease, as will be illustrated by a case to be reported below. In the last two years the gravity method of jejunostomy feeding has been satisfactorily used at the Massachusetts General Hospital in a number of instances. Search of the literature shows that this method was first mentioned by Kelling,<sup>1</sup> and was referred to in a paper by Colp<sup>5</sup> on external duodenal fistulæ.

Gravity feeding by jejunostomy requires but a simple apparatus. A two-litre container kept properly warmed is suspended at the head of the bed higher than the patient's body and is connected with the jejunostomy catheter by a soft rubber tube. A Murphy drip bulb is incorporated into the system, and a clamp for regulating the rate of flow is fastened to the tube proximal to the drip bulb. A slow continuous stream of fluid is supplied to the intestine and is taken up by peristaltic action as fast as the fluid is received. In this connection, it is important in performing jejunostomy to insert the catheter for at least half its length into the bowel in order that peristalsis of the jejunum at the end of the catheter may be as little interfered with as possible. The peristalsis of the upper jejunum of the dog exerts, as Alvarez<sup>9</sup> has demonstrated, a pull sufficient to sustain a weight of over 200 grams. In one patient a soft rubber tube was used to connect the reservoir and the jejunum and intermittent collapse of the tube, presumably from the pull of

jejunal peristalsis, was noted. The rate of flow through the jejunostomy tube from the reservoir is regulated by adjusting the clamp on the tube so that the amount of fluid to be given in one day runs in continuously in the course of twenty-four hours.

Feeding through jejunostomy can be started immediately after the operation. All the necessary nutritional elements can be given and in abundance. Fluids of high caloric value, such as glucose or lactose solutions, and milk and

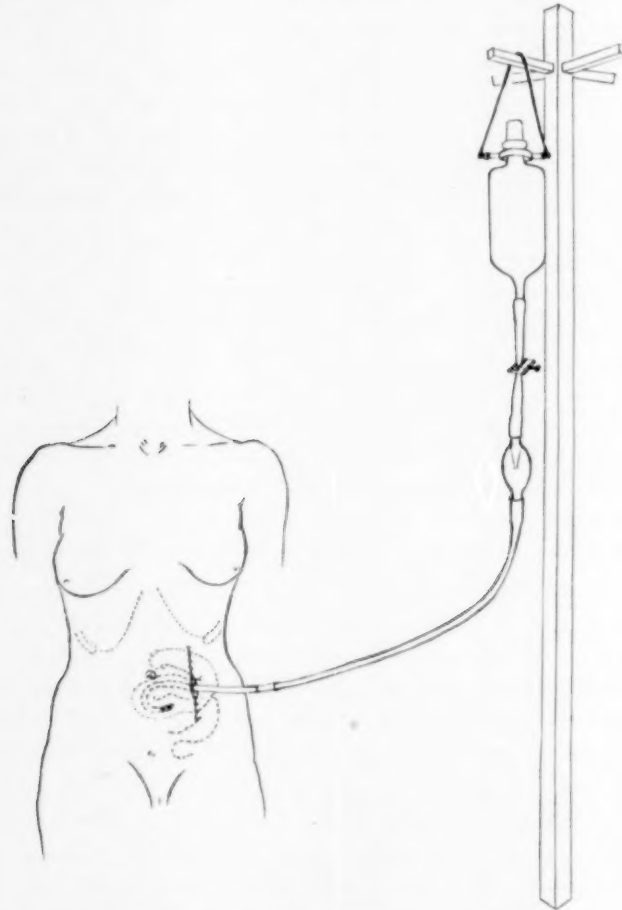


FIG. 1.—Note distance catheter is inserted into jejunum.

cream, are well borne. Ground meat, eggs, and peptonized milk may be given to supply essential amino acids. Vitamines, important in the treatment of many surgical patients, can be administered by feeding yeast concentrate, tomato juice, cod-liver oil, viosterol, and strained vegetables. A hæmatoplastic regimen in which vitamines, liver, and iron have their place is often indicated and is easily maintained.

The amount and character of the fluid to be supplied the jejunum will vary, of course, with the individual case. Such factors as the degree of

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dehydration and malnutrition, the amount vomited, the nature of the underlying disease, the size and age of the patient, and what is being taken by mouth determine the need to be met by jejunostomy feeding. As a rough guide it may be considered that the average adult patient should have three to four litres of fluid and three to four thousand calories daily, remembering that the protein, vitamins, and mineral salt requirements also must be met. In cases of external fistula communicating with the upper alimentary canal, such as biliary, gastric, or duodenal fistula, the discharges should be collected by constant suction and put into the gravity feeding reservoir.

The complications and ill effects of jejunostomy feeding by the gravity method are few. Leakage around the catheter and irritation of the skin may develop if the jejunostomy is put to prolonged use. Should the catheter accidentally be withdrawn from the jejunum it should be replaced within forty-eight hours, as the fistulous tract produced by the Witzel technic closes promptly. A mild diarrhoea sometimes results on a hyper-feeding régime. The studies of Scott and Ivy<sup>10</sup> on jejunostomy feeding in dogs led them to conclude that diarrhoea was due to excess of fat in the diet or to the irritating effect of raw fruit juices when introduced into the jejunum. Whether this conclusion is applicable to man is uncertain. In treatment of the diarrhoea opium derivatives or salts of bismuth and calcium may be given by the jejunostomy with alteration of the diet as indicated.

In the following illustrative case gravity feeding by jejunostomy was found invaluable.

R. L., a thirty-three-year-old housewife, came into the hospital July 17, 1929, with complaint of jaundice and itching of the skin. Ten months before admission the patient gave birth to a normal child. Two weeks later she was seized with severe pain across the upper abdomen, associated with indigestion but not jaundice. During the next four months she was troubled with recurring attacks of severe pain centering in the right hypochondrium. Following an attack six months before admission to this hospital she had cholecystectomy and appendectomy performed in another hospital. During the fourth week of her convalescence she became jaundiced, her stools became clay colored, her urine deep brown; pruritus set in and was soon quite distressing. Three months after her first operation, and three months before admission to this hospital, the patient underwent a second operation in the same hospital. At operation the right sub-hepatic region was found to be a mass of adhesions and it was considered impossible to perform any remedial operation. During convalescence there were repeated hæmorrhages into the wound despite blood transfusion. The jaundice continued until admission to this hospital, six months after the original operation, and the patient steadily lost weight and strength.

On admission to this hospital the patient was a thin, deeply jaundiced, enfeebled woman. At examination there was diffuse resistance in the upper abdomen, especially on the right, but no tenderness. A thin sero-purulent discharge oozed from an unhealed area in a right paramedian epigastric scar. The spleen was easily palpable, and although the liver seemed enlarged, no definite edge could be felt. The patient's evening temperature was 101° F. by mouth, her pulse rate 130. The leucocyte count was slightly elevated, there was a marked reduction in the hæmoglobin and erythrocyte count; the stools were gray and tests for bile were negative; the urine contained much bile. The liver function test showed a bilirubin level of 21.4 milligrams per 100 cubic centimetres

of blood. The sedimentation rate was increased; the clotting time was fifteen to thirty minutes; the bleeding time was normal.

July 29, 1929, operation was performed by Dr. Beth Vincent. Extensive dense adhesions bound together the under surface of the liver and the colon, stomach and duodenum. The common duct was obliterated, making impossible direct anastomosis between biliary tract and stomach or duodenum. The dilated stump of the hepatic duct was drained by suturing a catheter into it in order to establish an external biliary fistula for transplantation later. Blood transfusion was performed immediately afterwards. Convalescence was satisfactory, bile drainage through the catheter was free, and the jaundice gradually subsided, until on discharge four weeks after operation the sclerae were only faintly tinged. The patient was sent to a convalescent home until the fistulous tract should become well formed.

November 1, 1929, the patient, greatly improved, was re-admitted to the hospital. She was free from jaundice, she had gained weight, and she had not showed abnormal bleeding. Only 12 per cent. of the bromphthalein was retained in the liver function test; the icteric index was 10, the bleeding time three minutes, the clotting time twelve minutes.

November 6, fifteen weeks after the drainage operation, Doctor Vincent performed the second stage of the restorative procedure, the cutaneous end of the biliary fistula being cored out and freed up sufficiently to allow it to be sewed into the first portion of the duodenum. The operation was preceded by blood transfusion. On the second day after operation hæmorrhage into the wound occurred, and the wound edges parted to allow bile-stained fluid to escape. By the fifth day an external duodenal fistula communicating with the wound was well established. Fluids taken by mouth (including dyes) rapidly appeared at the wound, the skin became excoriated about the wound, and the patient began to grow weaker. One week after the transplantation procedure jejunostomy was performed under local anaesthesia. The operation was preceded and followed by blood transfusions. Gravity feeding was immediately instituted, as described above, making use of the following regimen:

- (1) Sips of water.
- (2) Normal salt solution, 180 cubic centimetres every hour into gravity tank.
- (3) "High caloric mixture" (cream, lactose, egg) 60 cubic centimetres every two hours into tank.
- (4) Sweetened orange juice, 540 cubic centimetres three times a day into tank.
- (5) Broths and gruels, 540 cubic centimetres three times a day into tank.
- (6) Milk, 540 cubic centimetres three times a day into tank.

In addition, the discharges from the fistula were collected by constant suction and were fed into the jejunum through the reservoir. In this way the patient took daily and without any discomfort over 11 litres (330 ounces) of water, salt, food and fluid recovered from the fistula; the total value was over 3,000 calories. The patient slept much of the time while being fed in this way. No further hæmorrhage from the wound or elsewhere occurred, the discharge from the fistula diminished in amount, and four weeks after operation the fistula had closed entirely. The bleeding and clotting time, prolonged after development of the external duodenal fistula, became normal with return of secretions to the jejunum and improvement in the patient's general condition. The jejunostomy tube was removed at the end of four weeks. On discharge from the hospital seven weeks after transplantation of the biliary fistula into the duodenum the patient's wounds were healed, she was eating with relish, the stools were brown and she was perfectly comfortable. The jaundice had disappeared.

It seems certain that the hyper-feeding by jejunostomy and the restoration to the upper intestine of essential secretions contributed largely to the successful outcome in this case.



## GRAVITY FEEDING BY JEJUNOSTOMY

Subsequent events show that this case falls into the group of partial successes following transplantation of external biliary fistula into the upper duodenum or stomach. The patient has been troubled with recurring attacks of upper abdominal pain, fever, and obstructive jaundice lasting two to five days, and accompanied by increase in the size of the liver. At a third operation the transplanted fistulous tract was dilated and a rubber tube was sutured into it, the tube to be discharged through the duodenum later. Whether this procedure will give the patient adequate biliary drainage remains to be seen.

The author wishes to thank Dr. Beth Vincent for permission to report this case.

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## PERFORATED PEPTIC ULCER OF MECKEL'S DIVERTICULUM\*

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MECKEL'S diverticulum, the persistent remains of the omphalo-mesenteric duct, occurs in approximately 1 to 2 per cent. of the human race. The wall of the diverticulum is generally of small-intestine type but may at times contain structures normally located in other parts of the digestive tract. Elements of gastric, duodenal and colonic character, also glandular tissue of pancreatic and questionable origin have been described within the walls of the diverticulum. Of these heterotopic structures, gastric mucosa is of greatest clinical importance since its secretion here as in the stomach has the ability to digest the intestinal mucosa and muscularis and lead to the formation of peptic ulcer. Mucous membrane of the gastric type is found according to Koch<sup>15</sup> in 12 per cent. and according to Schaetz<sup>25</sup> in 16.6 per cent. of Meckel's diverticula. As with peptic ulcers of the stomach and duodenum, those of Meckel's diverticulum are subject to hæmorrhage and acute perforation. The occurrence of a silent melæna as an indication of a bleeding ulcer of Meckel's diverticulum has been frequently stressed particularly by the pediatricians. Perforative peritonitis from ruptured ulcer of Meckel's diverticulum is equally as important as hæmorrhage but has not been accorded a commensurate degree of attention in medical literature.

The first demonstration of the relationship between perforation of a Meckel's diverticulum and peptic ulcer was by Hübschmann.<sup>12</sup> He reports the case of a boy of four and one-half years, who, twenty-four hours after a fall in which the abdomen was struck, began to suffer from repeated intestinal hæmorrhages. About four weeks after the onset of the illness signs of peritonitis appeared. Laparotomy was performed and the patient died shortly afterwards. At the post-mortem, the peritonitis was found to be due to perforation of a Meckel's diverticulum grossly gastric in structure. Hübschmann was able to demonstrate microscopically that almost the entire diverticulum was lined by fundus glands and that the perforation was located in intestinal portion just beyond the junction of the two types of mucous membrane. He pointed out that no signs of inflammation were present and that therefore infection would not have been the cause of the perforation. Six years before the appearance of Hübschmann's article Deetz<sup>6</sup> published the report of a boy of nine years who was successfully operated for a perforated Meckel's diverticulum. The diverticulum was amputated peripheral to the site of rupture precluding the possibility of determining the histologic appearance of the tissues about the perforation itself. In the excised diverticulum, pancreatic tissue and gastric mucous membrane were found. In his closing paragraph Deetz suggests that in this form of diverticulitis the conditions which lead to perforation may be the same as in gastric ulcer.

There have been relatively few cases of perforated peptic ulcer of Meckel's diverticulum reported as such. Aside from Hübschmann's case

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in which trauma was considered to have played some part and Deetz's case in which the region of the ulcer was not investigated microscopically, fourteen instances of perforated peptic ulcer of the diverticulum are recorded. Of these fourteen cases histologic examinations are lacking in four.

The first undisputed case of ruptured peptic ulcer of Meckel's diverticulum was published in 1915 by Gramen<sup>8</sup> who described in the diverticulum a lesion which possessed gross and microscopic characteristics of a perforated peptic ulcer. As in Hübschmann's case the lesion was located on the intestinal side of the junction between gastric and small-bowel types of mucosa. Four years later Müller<sup>22</sup> related having observed a recent perforation of a punched-out, calloused ulcer which was treated by simple suture of the hole. A second operation was performed after recovery from the first and at this time the diverticulum was excised. In the region of the previous perforation histologic examination showed both intestinal and gastric types of mucous membrane. In 1924 Brasser<sup>4</sup> published a typical case with the gastric mucosa of Meckel's in a state of chronic catarrh. The ulcer was found in the typical location, *i.e.*, on the intestinal side of the union between the two types of mucosa. In the same year a comprehensive survey of the subject, which included a detailed description of a case was published by Humbert.<sup>13</sup> The following year (1925), Ulrich<sup>30</sup> furnished another instance of perforated ulcer of Meckel's diverticulum due to the digestive action of the secretion from heterotopic gastric glands.

During 1926 reports of five cases were added. Stulz and Woringen<sup>28</sup> recorded two instances of perforation of Meckel's diverticulum due to lesions which grossly resembled peptic ulcer. However, a microscopic examination of neither specimen was made. Two additional cases were described by Kleinschmidt<sup>14</sup> who showed in his first case the presence microscopically of gastric mucous membrane in the diverticulum but was unable to examine the region of the ulcer which was destroyed by surgical clamps. The specimen obtained at operation in Kleinschmidt's second case of perforated diverticulum was lost before material for histology was excised. The fifth case published in 1926 was briefly mentioned by Neff<sup>23</sup> in a discussion of the paper by Abt and Strauss.<sup>1</sup> No gross or microscopic description of the lesion was given at this time. McCalla<sup>18</sup> in 1927 described a case of perforated ulcer situated at the junction of the ileum and a Meckel's pouch. The entire diverticulum was found microscopically to be lined by gastric mucous membrane. In the following year Hartglass<sup>10</sup> published the facts in connection with a recent perforation of a chronic ulcer located also at the base of a Meckel's diverticulum. Histologic examination showed the ulcer in the typical location with reference to the intestinal and gastric types of glands. The most recent report listed is that of Fèvre, Patel and Lepart.<sup>7</sup> These authors report two cases both with gross characteristics of peptic ulcer but with gastric mucous membrane in the lining of only one and duodenal mucosa in the other.

The number of perforations of Meckel's diverticulum due to peptic ulcer listed above in all probability does not even approximate the total number of cases that have actually occurred. Aside from those cases which are observed and not recorded there is a considerable number published as instances of diverticulitis with perforation. Particularly does this apply to the cases reported prior to Hübschmann's discovery. Earlier treatises on diseases of Meckel's diverticulum (see Denecke,<sup>6</sup> Hilgenreiner,<sup>11</sup> Turner,<sup>29</sup> Meyer<sup>21</sup> and Wellington<sup>32</sup>) contain a considerable number of perforations ascribed to various non-chemical causes. It is quite probable judging from the present high incidence of peptic ulcer as compared with other etiologic

factors of perforation that in a fair proportion of the cases contained in these compilations, the actual cause of the perforation, i.e., the peptic ulcer, was overlooked. Especially is this likely to be true of those cases of so-called spontaneous perforation where a demonstrable cause such as a foreign body is absent. For instance, in the case of Låwen<sup>16</sup> reported in 1909 the presence at operation of a spurting blood-vessel on the edge of the perforation is highly suggestive of the presence of an ulcer rather than of a phlegmonous diverticulitis in which category the lesion is classified. In case one of Meyer, that of a woman of seventy with a ruptured Meckel's diverticulum, the description of the lesion seems indicative of a perforated peptic ulcer. The gross and microscopic characteristics of the diverticulum point strongly to the presence of two distinct types of mucosa, the one manifestly intestinal, the other probably gastric. This lack of recognition of peptic ulcer as the cause of symptoms arising from lesions of Meckel's diverticulum can also be detected in reports subsequent to Hübschmann's publication. For instance, Mayo and Johnson<sup>17</sup> in 1926 recorded a case of bleeding from Meckel's diverticulum and ascribed the hæmorrhage to trauma to the polypoid or inflamed diverticular mucosa. Curiously enough the accompanying photomicrograph of the diverticulum, intended to demonstrate the polypoid overgrowth, exhibits typical gastric glands, the presence of which apparently was overlooked.

In addition to the perforations of Meckel's diverticulum recognized as resulting from peptic ulcer and those in which a peptic ulcer was probably overlooked, there is a third group in which an ulcer is present but is not suspected of actual perforation. This last group comprises cases in which there is found a typical penetrating ulcer extending through the entire thickness of the diverticulum having a base formed by an adjacent structure. The histories in a number of these cases suggest that they are examples of actual free perforation with subsequent spontaneous plugging of the hole. The antecedent occurrence of acute severe abdominal pain followed by the other manifestations of a diffuse peritonitis can hardly be explained on the basis of mere penetration. It is necessary in such an instance to infer actual perforation with leakage. The *modus operandi* is as follows: Within a relatively short period following rupture, a neighboring loop of bowel, portion of omentum or mesentery or merely a plaque of fibrin, becomes agglutinated to the site of perforation and the escape of intestinal content is thereby checked. The processes involved are very similar to those described in connection with spontaneous closure of perforated gastroduodenal ulcer (see Singer and Vaughan<sup>27</sup>) except that conditions for walling-off are not as favorable in the upper as in the lower abdomen.

The mechanism of spontaneous sealing is illustrated in two of the cases listed in the group of perforations reported as such. In Gramen's patient at the time operation was performed the pea-sized perforation which had led to a more or less diffuse peritonitis was effectively covered by a tag of omentum. At the autopsy of McCalla's patient who died of diffuse peri-

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tonitis, the base of the ulcer was found adherent to the anterior abdominal wall. It was apparent to the pathologist that the free perforation was of longer standing than the adhesions and that rupture had occurred some time prior. The case of peptic ulcer of Meckel's diverticulum reported by Meulengracht<sup>20</sup> as penetrating, in which the base was covered by a fold of mesentery, may rather have been an old sealed perforation. The lesion described by Guibal,<sup>9</sup> an excavation which extended beyond the walls of the diverticulum and which formed a pocket in the mesentery of the ileum, may have resulted from a previous perforation with attendant adhesions. The case reported by Peterman and Seeger<sup>24</sup> as a Meckel's diverticulum with hæmorrhage very likely was one of spontaneous closure of a perforation. The patient, a child of eight, had a history of previous attacks of melæna and one attack of intra-abdominal hæmorrhage following slight



FIG. 1.



FIG. 2.

FIG. 1.—External appearance of perforated peptic ulcer of Meckel's diverticulum. The perforation (p) is just proximal to the bulbous tip. A plaque of fibrin (f) torn in separating the diverticulum from the bladder presents a defect (d) which in the photograph simulates a lateral extension of the perforation.

FIG. 2.—Opened Meckel's diverticulum fixed in formalin and shrunk thereby. The lining of the proximal three-fifths comprised of intestinal mucosa (i) is thrown into folds (valvæ conniventes) and curled upon itself. The lining of the distal two-fifths which represents gastric mucosa (g) is thick, coarse, and devoid of true folds. The perforation (p) is located on the intestinal side of the junction of the two types of mucous membrane.

trauma. At the operation performed for the hæmoperitoneum, the source of bleeding was not sought. At a subsequent operation an ulcer of Meckel's diverticulum was found, the base of which was formed by the ileum. It is quite likely that the hæmoperitoneum encountered during the course of the first operation resulted from an ulcer which bled and perforated almost simultaneously. The first case of Aschner and Karelitz<sup>2</sup> listed by them as one of penetrating ulcer, presented at the primary operation evidences of recent peritoneal and diverticular inflammation including extensive enlargement of the mesenteric lymph-nodes. A palliative ileostomy was performed. Following recession of the signs of inflammation, a second operation was undertaken thirteen days after the first. A Meckel's diverticulum was



found adherent to the undersurface of the mesentery and in separating the two a hole was exposed which proved to be a peptic ulcer located in the ileum just proximal to the neck of the pouch. A massive granuloma in the first case of Meckel's diverticulum reported by Abt and Strauss may have originated in a perforated ulcer by a process similar to that in which a ruptured appendix leads to a chronic inflammatory tumor (pyogenic granuloma). The case reported below furnishes a further example of perforated peptic ulcer of Meckel's diverticulum with spontaneous closure of the hole. However, the sealing which was due to fibrinous adhesions was much more recent in this than in any of the aforementioned cases.

**CASE REPORT.**—J. S., a white boy of seven, was admitted to the Cook County Hospital, December 29, 1931, at 11:30 P.M., with the presenting complaint of lower abdominal pain. The illness which was described by the mother and child conjointly,

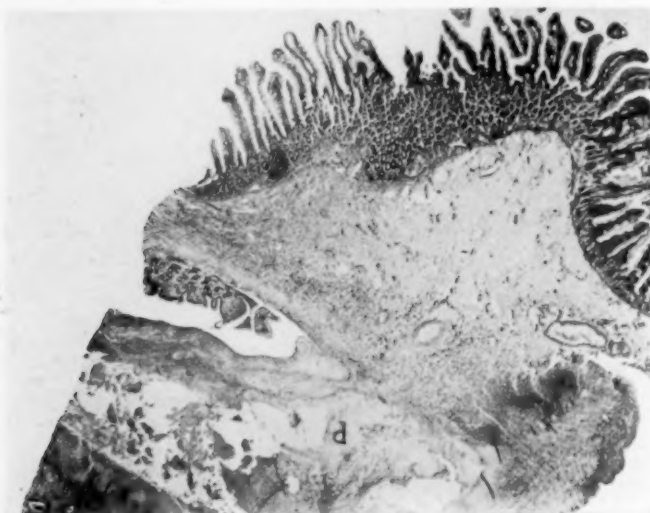


FIG. 3.—Peptic ulcer of Meckel's diverticulum cut tangentially through the site of perforation which is occupied by a mass of fibrin and debris (d). The lining glands are of the intestinal type and contain numerous goblet cells.

began December 28, 1930, at 1 P.M., when intermittent pain only moderately sharp was felt in the right lower quadrant. The patient was put to bed and a cathartic administered. The pain continued interruptedly until 3 P.M., when the boy fell asleep and awakened an hour later without pain. At 5:30 P.M. he ate his meal following which the pain recurred. It was noted at this time that movements of the right lower extremity or attempts to bear weight upon it resulted in an aggravation of the pain. Throughout that evening and night and the following day (December 29, 1930) a dull pain appeared at intervals until 6 P.M., when it reached its acme and became continuous. At this time any movement resulted in intense pain. An inventory of symptoms by systems yielded no pertinent information. The past history was essentially negative. There had been no similar attacks previously and no signs of melæna at any time.

The countenance of the child indicated that he was acutely ill and suffering pain. The temperature upon admission was 101° F., the pulse and respiratory rates 120 and 28 respectively. The essential physical observations consisted of tenderness and rigidity localized to the right lower abdominal quadrant. Peristaltic sounds were normally

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audible. The white blood count was 16,400. The diagnosis of acute appendicitis was made and laparotomy advised. At operation the appendix was found to be normal although there was a localized fibrinous peritonitis in the right lower quadrant. Exploration disclosed at the usual site of origin a Meckel's diverticulum which was attached by fibrinous adhesions to the right side of the superior surface of the bladder. Slight tension led to separation of the adhesions and exposure of a perforation in the distal half of the diverticulum. The latter was removed by clamp and ligature at the base and purse-string inversion. The recovery was uneventful and the patient was discharged January 9, 1931.

*Surgical Report.*—The diverticulum (Fig. 1) measured 4 centimeters in length and had a circumference at its base of 3 centimeters. The distal two-fifths of the specimen was somewhat bulbous. The entire serosa was injected and dull. Just proximal to the bulbous tip was a perforation (p) 2-3 millimeters in diameter. About the perforation was a thick plaque of fibrin (f) which exhibited a defect (d) presumably the result of a tear. The opened diverticulum (Fig. 2) presented two different types of lining. In the proximal three-fifths (i) the mucous membrane resembled that of the ileum, being thin and thrown into regular, fine folds on the order of valvulae con-



FIG. 4.

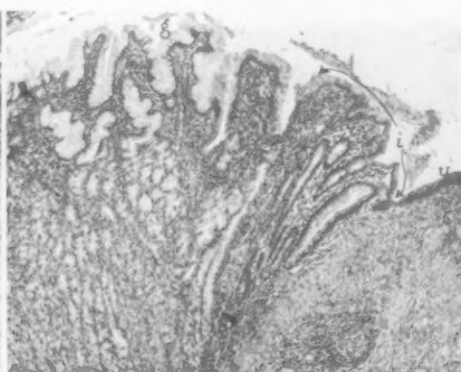


FIG. 5.

FIG. 4.—Photomicrograph of a portion of the ulcer beyond the point of perforation. Both proximal and distal borders of the ulcer are covered by mucosa of the intestinal type (i). A sudden transition from the intestinal to the gastric type of mucous membrane (g) occurs just beyond the distal margin of the ulcer (u) which is covered by a single layer of epithelium.

FIG. 5.—Higher magnification of the transitional zone within the rectangle indicated in Fig. 4. The gastric glands (g) are of the fundus type and the intestinal glands (i) are of the small bowel type. The epithelium covering the floor of the ulcer (u) is columnar.

niventes. The lining of the distal two-fifths (g) which had the appearance of gastric mucous membrane was so thick as to form a tumor-like swelling which almost filled the lumen of the terminal portion. A plug of mucus occupied the narrow lumen of this part of the diverticulum although no actual constriction separated the two types of mucous membrane. Upon close inspection, minute openings representing presumably the mouths of the gastric pits could be discerned. On the intestinal side of the junction of the two kinds of lining was a round defect (p) 4 millimeters in diameter which extended through the entire thickness of the wall and presented the usual characteristics of an acute perforation of a chronic peptic ulcer.

*Microscopic Description.*—In histologic sections of the proximal portion of the diverticulum the typical appearance of the intestinal wall is noted. (See Fig. 3.) In sections of the distal portion the microscopic picture is that of the stomach wall (see Fig. 5), the glands of the mucosa being of the fundus type, with numerous parietal cells. Preparations taken to include the region of the ulcer (Fig. 4) shows intestinal mucosa at both the proximal and distal borders, the latter passing over abruptly into

the gastric type. The margin of the ulcer in the region of the perforation exhibits the usual changes seen in similar lesions located in the stomach or duodenum. The edge consists of a cellular debris beneath which are successive layers of fibrinoid necrosis, young granulations and scar tissue. One margin of the ulcer shows evidences of healing, the floor of the defect (Figs. 4 and 5) being covered by a single layer of columnar epithelium. The muscular coats of the diverticulum correspond in type to those of the overlying mucous membrane. The intestinal portion possesses two well-defined layers, an inner circular and an outer longitudinal, whereas the gastric part exhibits smooth muscle bundles running in various directions without apparent division into layers.

*Symptomatology.*—Symptoms referable to the diverticular ulcer prior to perforation are, with the exception of hæmorrhage, seldom noted. The post-prandial distress of a rhythmic nature, so characteristic of peptic ulcer of the upper gastro-intestinal tract is only occasionally mentioned. Megévaud and Dunant's<sup>19</sup> patient, who was twenty-eight years of age, in one period of his illness in addition to hæmorrhages, suffered from abdominal pain which appeared before meals and was relieved by food. In the case reported by Kleinschmidt, a boy of fifteen experienced for a year prior to perforation a rhythmic distress which was located in the right lower quadrant and occurred one and one-half hours after meals. In the remaining cases no mention is made of symptoms resembling simple ulcer distress. The fact that most of the individuals are too young to give trustworthy information may account in part for the infrequency of history of previous ulcer complaints. Melæna, in contrast to post-prandial distress, is seldom absent in the history. The frequency of intestinal hæmorrhage has been emphasized repeatedly, particularly by the pediatricians. The statement, however, that melæna occurs in all cases in which gastric mucosa is found in Meckel's diverticulum (Barney<sup>3</sup>) is not borne out by the facts. Our own patient for instance had never suffered from intestinal hæmorrhage of sufficient grade to attract the mother's attention or to lead to signs of anæmia. The patient of Hartglass, a girl of fourteen, likewise gave no history of melæna. These hæmorrhages are frequently profuse and may be repeated at varying intervals, as in the cases of Humbert, Kleinschmidt, Stultz and Woringen (Case II) and McCalla. At times melæna immediately precedes the perforation as reported by Brasser and as likely occurred in the case of Aschner and Karelitz. Other symptoms such as abdominal cramps which may be attributable to the diverticulum rather than the ulcer are at times in the antecedent history.

The symptoms of perforation of peptic ulcer of Meckel's diverticulum apparently do not parallel those of perforated gastroduodenal ulcer in a large percentage of the cases. However, according to published reports in a few cases, the onset is sudden and violent, and evidences of a perforative peritonitis develop within less time than might be expected with a phlegmonous diverticulitis for instance. In Kleinschmidt's first case the onset was very sudden and at the initial examination made within less than three hours after the occurrence of pain, diffuse rigidity and tenderness were already noted. In his second case the pain of onset was likewise intense. The clinical ac-

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count given by Hartglass in which the patient was seized suddenly by a violent abdominal pain followed rapidly by the symptoms and signs of a diffuse peritonitis was like gastroduodenal perforation. In the first case of Fèvre, Patel, and Lepart there was likewise sudden onset of intense pain and the development of a diffuse peritonitis in less than twenty-four hours. It is not unlikely that the symptoms in a number of other cases were similar to those of acute perforation of gastroduodenal ulcer but that a careful inquiry was not or could not be made. Nevertheless, in a fair percentage of the cases, the onset is gradual and the peritonitis remains local. In our own case even after discovery of the perforation in the diverticulum, we failed in retrospect to obtain any history of intense or sudden pain or of symptoms of an initial widespread peritonitis.

The absence of an abrupt onset and the lack of development of a diffuse peritonitis in so many of the cases are explained by the limited quantity of leakage of a relatively non-irritating fluid. In most instances the escape of intestinal content is checked by the formation of adhesions. This is favored by the presence of adjacent intestinal loops and the overlying mesentery which move synchronously with the diverticulum. Occasionally the character of the content of the diverticulum may be the effective factor in preventing profuse leakage. In the case of Guibal a plug of thick mucus occupied the perforated portion of the diverticulum and occluded the hole. In the case herein reported a similar condition was encountered.

*Diagnosis.*—Prior to Hübschmann's demonstration of the relationship of perforation of Meckel's diverticulum to peptic ulcer the pathogenetic processes involved were considered to be identical with those of perforative appendicitis. The clinical distinction it was assumed could hardly be made. The knowledge that *the primary lesion is not a phlegmonous diverticulitis* but rather a peptic ulcer should help in the pre-operative recognition of a certain percentage of perforations of Meckel's diverticulum. Of most importance in the antecedent history is the occurrence particularly in children and especially boys, of melæna which generally constitutes the only manifestation of the unruptured ulcer. A story of post-prandial distress is generally lacking. The co-existence of a gastroduodenal ulcer and a similar lesion of Meckel's diverticulum as reported by Schreuder<sup>26</sup> is most exceptional and for practical purposes may be disregarded. The occurrence of sudden, violent pain beginning generally in the lower half of the abdomen followed almost immediately by the symptoms and signs of a diffuse peritonitis is characteristic of a perforated ulcer. When the patient is a child, the likelihood is still greater that the ulcer is located in a Meckel's diverticulum. The above peritonitis picture is hardly compatible with acute inflammation of the appendix which usually does not rupture until symptoms have persisted for twenty-four hours or so. The presence of free air in the peritoneal cavity which was noted at operation by Humbert constitutes a valuable Röntgen aid in the diagnosis of perforated gastroduodenal ulcer (Vaughan and Singer<sup>31</sup>). It is not to be expected early in cases of ruptured ulcer of

Meckel's diverticulum. The small bowel normally contains no appreciable amount of gas and only after ileus supervenes will air be available for escape through the perforation.

NOTE.—Since the above article was submitted for publication an additional report dealing with the subject has appeared in print (Cobb, D. B.: Perforated Peptic Ulcer of Meckel's Diverticulum. *ANNALS OF SURGERY*, vol. xciv, pp. 256-262, 1931). The observations recorded by Cobb illustrate a number of the points discussed in this paper including the tendency to spontaneous sealing of the perforation.

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## BENIGN TUMORS OF THE STOMACH\*

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THE caption, "Benign Tumors of the Stomach", is employed to direct attention to the occurrence of definite, non-malignant tumors and polypoid masses of hypertrophied mucosa of the stomach in individuals with the clinical history and Röntgen-ray findings of stomach disease.

The fact that approximately a thousand cases of benign tumors of the stomach have been observed within recent years would lead one to believe that the disease is not rare, and that we should have progressed past the stage of isolated case reports in the study of the disease. When it is remembered, however, that during the same period many thousands of cases of ulcer and cancer have been encountered, benign tumors must be looked upon as comparatively rare.

But not all the recorded cases of benign tumor of the stomach are reported in sufficient detail to give accurate means of diagnosis, or conclusions as to the best method of treatment; hence we have not yet been lifted out of the stage of case reports into the stage of organized knowledge of the subject.

The purpose of this report is, to put on record certain important details of the clinical and röntgenological study and operative treatment of a case of benign tumor of the stomach and to bring to attention certain studies from literature.

The case is one of massive vomiting of blood in a young man who showed, upon röntgenological examination, a definite ulcer on the stomach side of the pylorus and a pedunculated polypoid mass of greatly hypertrophied mucous membrane of the stomach prolapsing into the duodenum.

A colored man, twenty-three years old (Case No. 31-9156) was admitted to St. Philip's Hospital March 19, 1931, immediately after vomiting a large quantity of blood. He was in serious shock, had a temperature of 97, pulse 130, blood pressure 100/55 and was in a desperate general condition. His blood examination showed 18 per cent. hæmoglobin, 1,110,000 red cells. There was a history extending over fourteen months, of vague stomach distress, but the symptoms were not continuous, nor sufficiently definite to lead one directly to the stomach. He had a history of syphilis, and his blood Wassermann was strongly positive.

Two days after admission and for several days thereafter, his stools contained much blood. His hæmoglobin was 11 per cent., red cells 890,000. Frequent blood examinations were made, for a while daily and semi-daily, until on May 25 (ten weeks),

\* Read before the Richmond Academy of Medicine, March 22, 1932.

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his haemoglobin was 62 per cent., the red cells 3,580,000, and there were the usually found elements indicating blood regeneration. The stomach contents showed free HCl of 14 and total acidity 28.

It seemed unwise to make an X-ray examination of the stomach until twelve days after admission, at which time it was found that he had a marked, constant deformity (filling defect) of the pylorus, with hyper-motility, rapid emptying of the stomach and other signs of gastric syphilis, and a tumor in the region of the pylorus, indistinguishable from carcinoma.

He was treated with the popular dietetic and medicinal remedies for secondary anaemia and syphilis. X-ray examinations were repeated April 16, April 29, and in

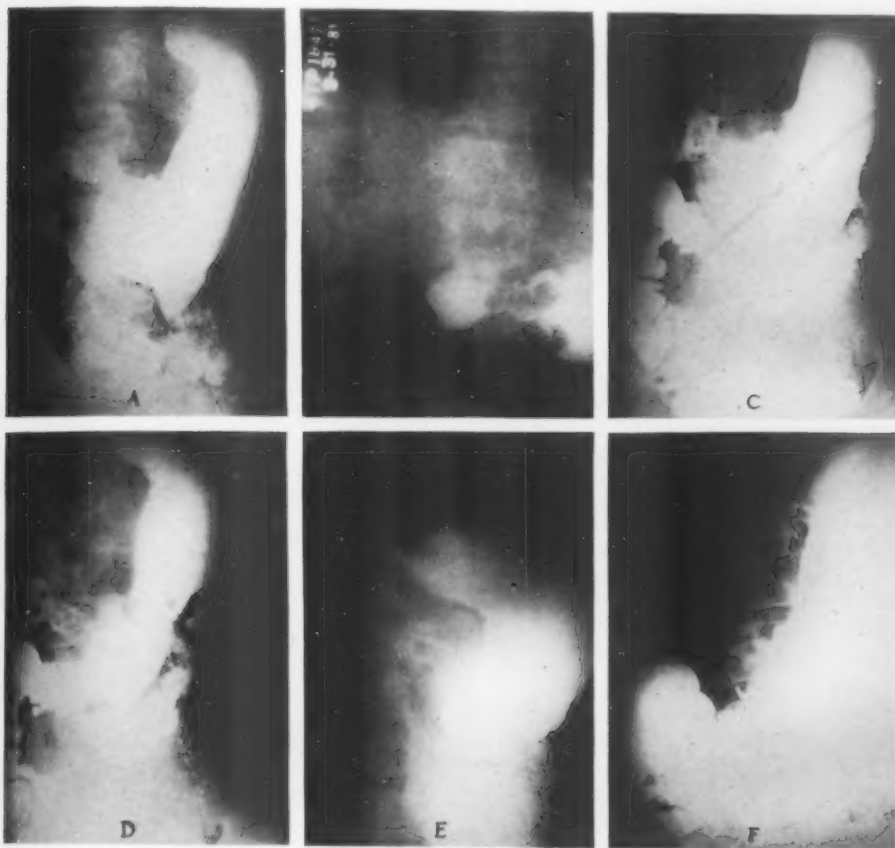


FIG. 1.—Röntgenograms of a case of hypertrophied mucous membrane of the stomach, pedunculated and prolapsing into the duodenum.

June, at which the same findings previously noted were present, though the filling defect in June in the region of the pylorus was about half the size noted at the first examination, March 31.

This patient remained in the hospital until May 28, at which time he seemed to be clinically well. His blood rapidly returned to normal, his appetite was good, digestion good, blood Wassermann reaction negative. He was referred to the dispensary for further treatment and observation.

He was readmitted to the hospital November 11, 1931, stating that for three days he had had epigastric pain partially relieved by food; some nausea and vomiting of blood the night before admission. He now looked well, his blood examination showed 95 per

cent. hæmoglobin, 5,150,000 red cells, his stools and gastric contents contained blood, blood Wassermann was negative.

The röntgenological report of November 12 is as follows: (E. Lee Shiflett) This report is made after a careful re-study of the films made at the time of his previous stay in the hospital and of those made in November, just before operation. Barium passes through the cesophagus and into the stomach without delay. The stomach fills readily and is normal in size and position. It is slightly atonic and peristalsis is quite sluggish. The pre-pyloric region presents an unusual appearance. In the upright position it fills smoothly with no defects. (Fig. 1 A.) In the prone position there are irregular filling defects which have the appearance of being produced by objects within the lumen, and not by induration of the stomach wall. At times the pylorus appears serrated (Fig. 1 B); again, the defects are multiple and seem to be surrounded by thin shells of barium which extend through the widened pyloric canal into the duodenum. (Fig. 1 C and D.) At other times the stomach is smooth to the pyloric ring, but in the antrum there is a single, central, irregularly circular translucency which is outlined by a thin line of the opaque mixture (Fig. 9 F), obscuring the duodenal cap. There is a large ulcer crater on the lesser curvature just proximal to the antrum. The duodenum is slightly dilated, and is never completely filled. Here, too, there are multiple oval to round central defects of a translucent nature, which seem to be due to objects within the duodenal lumen. At times the gastric and duodenal defects are definitely continuous. (Fig. 1 C, D, E.) The gastric and duodenal defects cannot be demonstrated in the erect position. (Fig. 1 A.) They are seen only with the patient prone. There is at no time any disturbance of the contour of the bulb. The second and third portions of the duodenum are normal.

*Six-hour examination.*—There is a gastric residue estimated at 10 to 15 per cent. The remainder of the meal shows normal advancement, and demonstrates no additional pathology.

*Conclusion.*—The findings are compatible with gastric syphilis with ulcer. There is hypertrophied gastric mucosa and a pedunculated tumor of the stomach which at times prolapses through the pyloric canal into the duodenum. There has been no appreciable change in the condition since the first examination, March, 1931, except the ulcer crater, which first made its appearance five months ago, is now further advanced and is penetrating. The general survey of the whole clinical situation was quite conclusive that this was not a malignant disease.

Operation was performed November 18, 1931. Through a transverse incision good exposure was secured. The stomach was normal in size; there were no adhesions. On the lesser curvature about two inches from the pylorus there could be felt an area of induration about the size of a silver half dollar, extending to the posterior wall of the stomach. With the stomach drawn up, a movable tumor could be felt just proximal to the pylorus extending through the pyloric ring into the duodenum. The tumor could be seen through the wall of the duodenum, and could be pushed back into the stomach and back into the duodenum at will. (Fig. 2.) It was realized at once that there was present a prolapsing tumor of the stomach.

The first three inches of duodenum was easily mobilized after dividing the outer layer of the peritoneum. The distal half of the stomach and the first inch of the duodenum were removed in one piece, and the ends of the stomach and duodenum united by the Haberer method.

The pathological examination was made by Dr. Lewis C. Pusch.

*Gross Description.*—A segment of pyloric portion of the stomach, 6 centimetres long, 10 centimetres in circumference at its upper extremity and 3 centimetres in diameter at its lower extremity. (Fig. 3.) There are two ulcers, 3 and 3½ centimetres long, which extend to distal plane of excision, but which are bordered proximally by hypertrophic mucosa which overhangs smooth bases. The ulcers are irregular in shape, each 1½ centimetres in greatest width, and separated by a polypoid mass of hypertrophic

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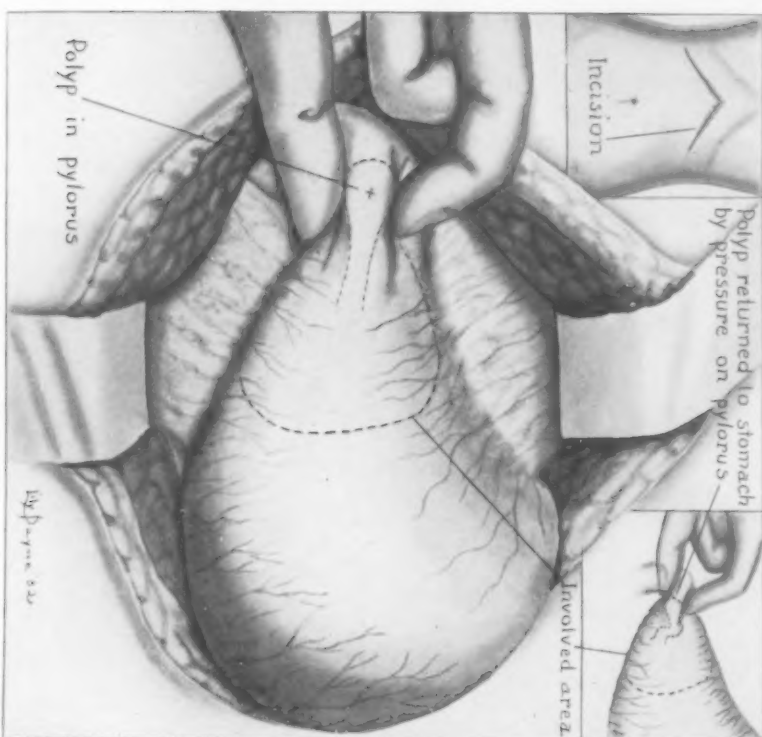


FIG. 2.—The pedunculated tumor from the stomach prolapsing into the duodenum.

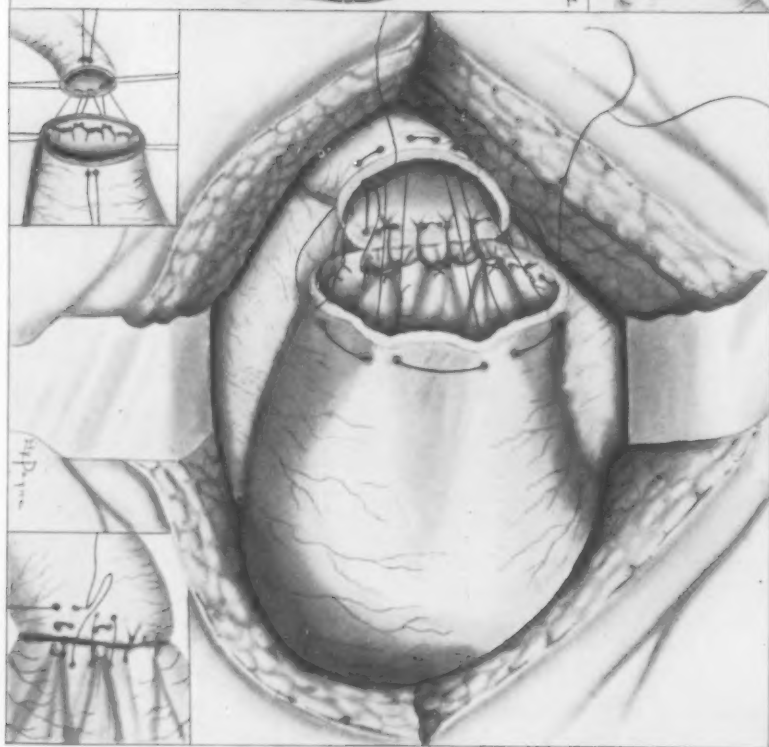


FIG. 3.—End-to-end anastomosis of stomach to duodenum after resection for pedunculated tumor of stomach.



mucosa 5 centimetres long and  $2\frac{1}{2}$  centimetres high, wedge-shaped, continuous as a polypoid mass  $2\frac{1}{2}$  centimetres in diameter, mucosal covered, occupying the orifice of the distal extremity. Attached lymph glands are moderately enlarged.

*Microscopic description.*—Pronounced mononuclear cell infiltration, among which plasma cells are numerous, diffuse and intense about bases of ulcers, focal and bulky—chiefly perivascular—throughout other strata. An occasional gummatoid focus occurs, chiefly submucous in position. Endothelial hyperplasia and endarteritic intimal thicken-

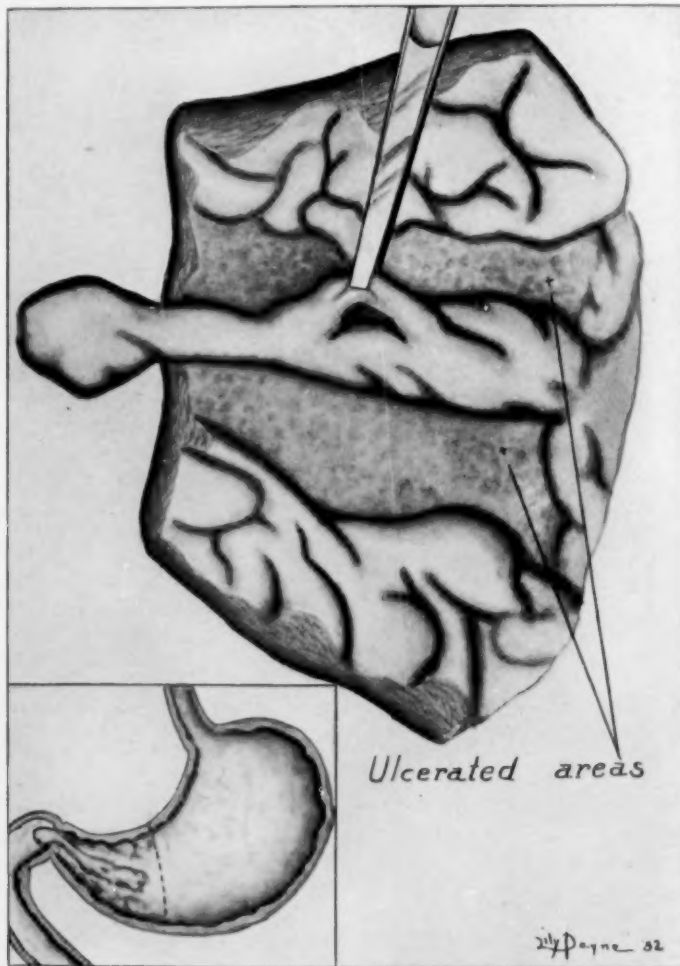


FIG. 4.—Pedunculated hypertrophied mucous membrane of the stomach prolapsing into the duodenum.

ing are seen in blood vessels. It is improbable that the reaction is non-specific. Polypoid masses have an organized hypertrophied mucosal structure, not neoplastic.

*Pathological diagnosis.*—Syphilis of the stomach with ulceration and polypoid hypertrophy of mucosa.

His convalescence was normal. He was out of bed on the eighth day. Röntgenological examination made three weeks following operation showed his stomach functioning well. He has remained well up to the present time, with the exception of one

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night about six weeks after operation; after overeating he had an attack of vomiting for which he was kept in the hospital three days for observation.

March 17, 1932, four months after operation, the röntgenological report is as follows: There has been a resection of the pylorus and the first portion of the duodenum with an end-to-end anastomosis. The stomach and the site of the anastomosis are entirely free of defects and pathology. There is free and rapid emptying, and the stomach is entirely empty at six hours. There is a slight hypermotility of the barium meal, but the gastric function is entirely satisfactory.

The subject of benign tumors of the stomach has been extensively studied for less than ten years. Eliason, Pendergrass, Miller and Wright, working as a group in Philadelphia, have personally encountered more than eleven cases; Balfour and his co-workers have reported fifty-eight cases from Rochester up to 1927; Lockwood reports twelve cases seen during the past seven years; Meyer and Singer, from Chicago, and Matas, from New Orleans, have given beautiful descriptions of prolapsing tumors and mucous membrane of the stomach into the duodenum. A great many scattered and isolated cases and small groups of cases are reported in literature. The disease, like many other so-called rare affections, will be found to be not so rare when carefully and specifically looked for.

The outstanding facts may be summarized for consideration.

The lesions will be found to include practically all types of benign tumors, varying greatly in size, occurring in any part of the stomach, with great frequency found on the mucous and submucous coats and may be pedunculated. They are most frequently found in the pyloric portion of the stomach, least frequently in the cardiac area, and are often multiple. They may occasionally undergo sarcomatous or cystic changes, or may be associated with cancer, which at times appears to be an effect of transformation of benign into malignant disease.

Frequently the tumor will consist of a large area of hypertrophied membranous mucous membrane. Although this type of pathology cannot be classed histologically as a true neoplasm it is productive of the same symptoms, and commands the same treatment.

Ulcer is a frequent associated condition. Usually the ulcer is at the base of the tumor, occasionally at some distance away. Cancer was found to be a secondary development in 35 per cent. of 23 cases subjected to thorough examination according to the reports of Miller, Eliason and Wright. Other observers have noted much lower incidence of malignancy.

In cases of clinically recognized cancer of the stomach, approximately 4 per cent. are believed to have been originally benign tumors; and Ewing suggests that all bulky polypoid carcinomata may have been in the early stages benign polyps.

As to the etiology of benign tumors of the stomach, little is actually known, and much explanation offered. In the case of localized hypertrophied mucous membranes, certain factors such as low-grade inflammatory reaction, and especially syphilis, are offered as explanation. Syphilis has been mentioned probably more frequently as a cause than any other single factor.

So far in all the cases reported, the Wassermann reaction was negative or not stated. In our case the Wassermann was strongly positive and the pathological studies would indicate that the underlying etiology was syphilis. This is the only case in which this seems to be the undoubted etiology.

The effects of peristalsis may be a factor in producing prolapse either of the pedunculated tumor or mucous membrane hypertrophy through the pyloric canal into the duodenum. When peristaltic contraction occurs, the pedicle of the tumor may become stretched toward the pylorus and finally may be elongated sufficiently to permit prolapse into the duodenum.

The clinical symptoms are those of abdominal indigestion, recurrent pain, nausea and vomiting, often of blood, and anæmia; in a word, the symptomatology of dyspepsia, ulcer disease or cancer. Pyloric obstruction of an intermittent character, by a ball-valve type of tumor with pedicle, will produce a characteristic syndrome of gastric crisis or ileus as was observed especially by Matas and by Meyers and Singer.

*Diagnosis* must be made by röntgenologic studies. A carefully conducted fluoroscopic and röntgenographic examination must be combined. The patient should be examined in the vertical and the horizontal positions, and especially in the right oblique prone position. The latter is especially important for the detection of prolapsing tumors, hypertrophied gastric mucous membrane and true duodenal tumors. Moore advocates the following procedure: The stomach should be observed carefully as it fills, and should be scrutinized from every direction, as a tumor in the cardiac portion may cause a splitting of the barium column. Forceful palpation with the abdominal musculature relaxed enables the walls of the stomach to be approximated and a filling defect is more easily detected. If too much barium is present small growths and small lesions may be overlooked. Although there is no "type characteristic" by which tumors of the stomach can be differentiated, benign tumors give röntgen appearances which, though not always conclusive, form a reasonable basis for diagnosis. The filling defect is that of a circumscribed or punched-out defect in the barium shadow, usually on the gastric wall, leaving the curvatures regular and pliant. Peristalsis is not interfered with and the rugæ are obliterated at the point of origin of the tumor. There may be an associate niche of an accompanying ulcer. A non-complicated growth will not show a niche and there will be no incisura.

Benign tumors near the pylorus possessing sufficiently long pedicles may prolapse into the duodenum. The duodenal defect may be a central circular, oval or multilocular radiolucency completely surrounded by a thin shell of the opaque mixture. Usually there is no disturbance of the contour of the bulb. There is no prepyloric deformity or filling defect and there is a six-hour residue, slight or considerable, depending on the amount of obstruction produced. This type of tumor must be differentiated from true duodenal tumors which cause similar filling defects in the duodenal bulb. Golden attaches considerable importance to the presence or absence of a six-hour residue in differentiating these two conditions. A filling defect suggesting

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a new growth in the duodenal bulb, accompanied by a six-hour residue, is indicative of a prolapsing tumor, while the absence of the six-hour residue is indicative of the tumor arising in the duodenum itself. The value of this sign is not absolute, but has been of tremendous diagnostic importance in practically all cases reported to date. Rigler observed under the fluoroscopic screen the actual prolapse of a benign growth of the stomach. He demonstrated the defect in the erect position, and there was no six-hour residue. The case of metastatic sarcoma, previously reported by us, caused a filling defect in the duodenal bulb which was demonstrated in the erect position and produced a considerable six-hour residue in the presence of a markedly dilated and atonic stomach. The finding has proven too valuable to be disregarded because of several exceptions. A larger series of case reports will determine its real value as a differential diagnostic finding.

The röntgen findings in cases of prolapsing mucous membrane have been adequately described by Eliason, Pendergrass and Wright and are strikingly different from those of pedunculated prolapsing neoplasms. Our case had all the characteristics described by these authors. (Fig. 1.) There is a prepyloric deformity determined by the amount of the hypertrophy of the pyloric structures. If a large amount of membrane is hypertrophied, the immediate one or two inches of the pyloric area will show a large filling defect, with or without the presence of barium. The defect may be very irregular, presenting a serrated appearance that may be misinterpreted as carcinoma. If the amount of hypertrophy is small, we may see enlarged rugal markings, the appearance being similar to that produced by pressure of the spine on the barium-filled stomach. A smaller amount of hypertrophy causes a thinning of the barium at this point, as compared with the remainder of the barium-filled lumen of the stomach.

If the attached area of hypertrophy has been lengthened out and formed a polypoid mass projecting through the pylorus into the duodenum, two filling defects will be observed; one in the bulb being due to the prolapsed polypoid growth; the one in the pylorus being due to the large redundant collar of mucous membrane. There is always a gastric residue, the amount depending upon the amount of pyloric obstruction and the secondary effects upon the function of the stomach.

The differential diagnosis of benign tumors must consider all those conditions which may involve the pylorus and the duodenum. The clinical course, dangers and treatment of the disease, are readily demonstrated in all cases which have been adequately reported. It is scarcely conceivable that it is spontaneously curable. The clinical symptoms are subject to periods of exacerbation and remission in intensity. The fact that nearly all of these tumors are located in the active pyloric portion of the stomach accounts for the active symptomatology. The patient has signs resembling those of ulcer, and ulcer actually exists in more than two-thirds of the cases, and cancer is found often enough. Haemorrhage is practically always present, either as occult blood found in the stomach or intestinal contents, or in great fre-

quency in the form of a massive and near-fatal hæmorrhage. Secondary anæmia, resulting from slow bleeding over a long period of time, has been mistaken by competent clinicians as pernicious anæmia, until the true condition had been recognized by the röntgenologist.

The gastric crisis resulting from pyloric blocking of the prolapsing tumor, always productive of serious consequences, was nearly fatal in the case of Matas, complicated by intussusception.

The chief dangers of death in benign tumors may be summarized as: Hæmorrhage, pyloric obstruction and cancer.

*Treatment.*—These well-known diagnostic difficulties furnish food for thought when we see so many cases of ulcer disease fail to respond to treatment by the rigid dietetic, medicinal and other remedies employed in the exacting regimen implied by the medical treatment of ulcer. The so-called "ulcer syndrome" upon a basis of tumor, cannot be cured without operation. When the abdomen is opened and ulcer demonstrated, the stomach should be thoroughly examined, sometimes through an incision into its cavity, before the existence of tumor can be denied. The question as to whether the operation should remove only the tumor or the pyloric portion of the stomach can be answered by a brief consideration of the pathology of the disease and a reference to the results of treatment of reported cases. The fact that the lesions are multiple, associated with ulcer, and frequently lead to cancer, calls for excision of the pyloric region of the stomach. In only the exceptional case, could removal of only the tumor be expected to cure. With the modern technic employed in resection of the stomach for benign disease, the mortality is extremely low. The Haberer method of end-to-end, or the Finney method of end-to-side anastomosis of the stomach to the duodenum, should be applicable to all cases save those in which the coincident ulcer is located too far away from the pylorus. An occasional case of this sort may necessitate the Polya or Balfour method of anastomosis.

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## ADVANCED GASTROJEJUNAL ULCER \*

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GASTROJEJUNAL ulcer still remains a problem of absorbing interest to the abdominal surgeon. From the welter of work in gastric surgery comes no unanimity of opinion as to its incidence and cause or prevention. Its surgical treatment has been undertaken with increasing boldness, as seldom is much gained by medical measures; and yet satisfactory solution of the best procedure in the case in hand, not only to relieve the existing condition, but to prevent recurrence, may tax the ingenuity and judgment of the operator to the limit.

*Occurrence.*—Gastrojejunal ulcer occurs almost exclusively in men, as far no case has ever been reported in a woman (Walton<sup>22</sup>). Smead,<sup>†</sup> however, refers to the case of a woman in whom a gastrojejunal ulcer, proved at operation, developed two and one-half years after a gastroenterostomy. It most commonly has its origin in a previously performed gastroenterostomy, though it may follow also a partial gastrectomy. The antecedent lesion has almost invariably been a duodenal ulcer. Balfour<sup>1</sup> states that gastrojejunal ulcer is almost unknown following excision, and gastroenterostomy for gastric ulcer. Key<sup>10</sup> has recorded a case as jejunal ulcer after gastroenterostomy for gastric carcinoma, but Wilkie<sup>23</sup> believes the evidence is unconvincing. It may arise within a few months, more often within two to three years of the primary operation or even later; Moynihan<sup>17</sup> states it is usually within two years, but Luff,<sup>13</sup> in his exhaustive report, finds 38 per cent. occur within two years and 62 per cent. from two to eight years.

Statistics of its incidence vary. In the early reports, notably that of Van Roojen,<sup>21</sup> in 1910, marginal ulcer was found in 1.58 per cent. of gastroenterostomies, and more commonly in the anterior operation. It seems more likely to occur when artificial pyloric occlusion is done at the same time. More recent figures show a wide variation. After gastroenterostomy, Moynihan<sup>16</sup> has found gastrojejunal ulcer in 1.84 per cent. Rowlands<sup>19</sup> reported 2 per cent. Luff,<sup>13</sup> in his report for the British Medical Association on the after-history of gastroenterostomy, based on 995 cases from numerous operators, reported gastrojejunal ulcer in 2.8 per cent. Nystrom<sup>18</sup> quotes German statistics as showing 3 per cent. In this country Gibbon<sup>7</sup> cites less than 1 per cent.; Douglas,<sup>5</sup> 1.6 per cent.; Horsley,<sup>9</sup> 3 per cent.; Hartwell,<sup>8</sup> 3.7 per cent.; St. John,<sup>20</sup> 6.9 per cent. Lewisohn<sup>12</sup> claims a percentage varying from 12 per cent. to 34 per cent. Balfour,<sup>1</sup> in studying ten-year end-results in 491 cases, found gastrojejunal ulcer in 3.26 per cent.

\* Read at the meeting of the Johns Hopkins Surgical Society, February 5, 1932.

† Personal communication.

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The percentage of marginal ulcer following gastric resection is given by St. John<sup>20</sup> as 3.6 per cent. Balfour<sup>2, 3</sup> quotes Bergfeld as reporting fifty-three cases from the literature and reports thirty-one cases from the Mayo Clinic. Of these latter, eighteen followed some type of gastrojejunostomy.

*Etiology.*—(1) Lack of proper after-treatment. Improper diet and régime. (2) Persistent hypertonic and hyperacid stomach, often from excessive smoking or use of alcohol, *etc.* (3) Remaining foci of infection which may have caused the original ulcer and similarly cause the jejunal ulcer. (4) Infection at the suture line. (5) Anatomical errors at the stoma. Badly placed stoma or badly chosen type of operation. Lack of accurate approximation of the mucosa. Submucous hæmatoma particularly at the cardiac angle of the stoma (Montgomery<sup>15</sup>). (6) Some constitutional defect that permits repeated formation of ulcers, *i.e.*, some nervous or trophic disturbance. Patients that have a peculiar liability to the formation of ulcer. (7) Use of non-absorbable sutures in the mucosa, and improper application of clamps.

These may be summarized as consisting really of three definite groups: (1) Improper after-treatment. (2) Errors in operative technic. (3) Constitutional tendency to form ulcer.

It is said that gastrojejunal ulcer is exceptionally prevalent in Spain because of the difficulty in supervising proper after-treatment. (Casanova-Seco.<sup>4</sup>)

*Pathology.*—The ulcer is usually in the line of anastomosis, but may occur in the jejunum within two to three centimetres of it, where it has a great tendency to perforate. It may involve only a small portion of the stoma or its entire lumen with very extensive inflammatory infiltration of the adjacent mesocolon, and, finally, it may partly or completely close the stoma or perforate into the colon to form a gastrocolic fistula. It has a great tendency to bleed. Fohl<sup>6</sup> states that blood in the stool is never absent. Hæmorrhages are often profuse; there is usually melena and tarry stools, but never hæmetemesis. Even after extensive resection for a marginal ulcer, when a new gastrojejunostomy of some sort has been done there is a great tendency to recurrence.

*Symptomatology.*—The characteristic symptoms of gastrojejunal ulcer are pain one-half to one and one-half hours after eating, similar to or more severe than the original ulcer pain, the pain being located to the left of the mid-line in the epigastrium; *i.e.*, at the location of the ulcer. There will be tenderness at this point on palpation. Vomiting may occur when there is obstruction at the stoma. As in other types of ulcer there may be a great tendency to remission of symptoms and periodic recrudescence. The pain may often be relieved by food or alkalis but occasionally by neither. Clinically, there are two types: (1) Acute fulminating perforation of a jejunal ulcer close to the stoma with no premonitory symptoms. (2) Slowly infiltrating and perforating marginal ulcer with periodic exacerbation of symp-

toms, and an insidious course of remissions with finally perforation into the colon or stomach.

A gastrocolic fistula may be suspected when there are foul eructations and fecal vomiting, with diarrhoea, the stools showing undigested food. The X-ray may aid in the diagnosis by demonstrating a deformed or painful stoma or obstruction, if any is present, and a barium enema can demonstrate a gastrocolic fistula, but usually the diagnosis must rest upon the characteristic symptom complex.

*Treatment.*—While medical measures may give temporary relief, there are few, if any, cases cured without surgery. Surgical procedure depends upon the type of lesion found. It may be: (1) Closure of a perforated ulcer. (2) Preliminary jejunostomy. (3) Simple excision of ulcer. (4) Excision of ulcer and abolition of the stoma. (5) Excision of ulcer and abolition of stoma and gastroduodenostomy or pyloroplasty. (6) Pylorotomy. (Koch.<sup>11</sup>) (7) Partial gastrectomy with abolition of stoma, followed by a Polya or a Roux type of anastomosis. (8) For gastrocolic fistula. (a) Extensive resection of stomach, colon and jejunum. (b) Resection with restoration of stomach and duodenum and colostomy or simple closure of the opening in the colon.

When the original duodenal ulcer is found to be healed and the marginal ulcer small, abolition of the stoma with excision of the ulcer is the most satisfactory operation; rarely will simple excision of the ulcer suffice. When the duodenal ulcer is still present, abolition of the stoma with resection of the marginal ulcer should be supplemented by a pyloroplasty or gastric resection.

In advanced gastrojejunal ulcer, so-called "protected perforated" cases (Balfour) with wide inflammatory reaction in the mesentery of the colon, Mayo-Robson,<sup>14</sup> formerly, and Balfour,<sup>3</sup> more recently, have advocated a preliminary jejunostomy for feeding, to permit by rest of the ulcer area recession of the reaction and partial healing of the ulcer, so that a later resection may be more easily and safely undertaken.

For operation on an ulcer recurrent in the stoma following gastric resection and in repeated recurrent ulcer a Roux or Y type of anastomosis may offer the best solution. Balfour<sup>3</sup> has stated that in re-operation: (1) Trauma to the mucosa must be kept at a minimum. (2) There should be a radical change in the type of anastomosis. (3) Added jejunostomy for feeding must be considered. (4) Careful post-operative treatment should include proper diet, elimination of all foci of infection, and no alcohol or tobacco.

*Case Reports.*—The present report is based on two cases in neither of which did any of the above procedures seem applicable. A brief résumé follows:

CASE I.—Male—aged forty-three years, married. Admitted April 10, 1930. For six months previously he had had typical symptoms of gastrojejunal ulcer. Pain in epigastrium and to the left, fairly constant, colicky at times, worse with constipation. Vomits almost every evening one and one-half hours after evening meal food eaten dur-

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ing day. Appendectomy fifteen years ago. Six years later he had a ruptured duodenal ulcer with gastroenterostomy. Also, recently he had pain in the epigastrium fifteen to twenty minutes to two hours after meals. He belches frequently and has gnawing pain at times. He has had jaundice for the last three days.

*Examination.*—Undernourished. Icteric tint to sclerae. Marked epigastric tenderness. No rigidity. Pyorrhoea and a few non-vital teeth. Icterus index, 13.

*Clinical course.*—Jaundice increased in next four days. Vomited foul material at times. Soreness on right and left upper abdomen persisted. *Wassermann.*—Negative. Gastric analysis: Slightly high acid curve. Coagulation time, five and one-half minutes. X-ray shows old stoma with extensive gastrojejunal ulcer. No gall-stones. A two-stage operation was deemed advisable: (1) To relieve jaundice. (2) To cure marginal ulcer.

*Operation I.*—Right rectus incision. Cholecystostomy. Marked adhesions about gall-bladder, cholecystitis grade 2. No stones. The glands at the cystic duct were enlarged. Common duct was negative. Head of pancreas was thickened. No duodenal ulcer. Large gastrojejunal ulcer.

*Post-operative course.*—Normal convalescence. Gall-bladder drained well and jaundice cleared up. Closure of fistula in three weeks.

*Operation II.*—Left rectus incision. Ulcer found involving the complete circumference of the gastroenterostomy stoma fully one centimetre of induration about it. Marked mesenteric thickening and pulling down of colon toward it. Gastroenterostomy was taken down by freeing the stomach from above through an opening in the gastrocolic omentum, and the jejunum was trimmed away from below, leaving the ulcer attached to the orifice in the mesentery, 3 inches of jejunum resected. The ulcer area was cauterized and drained. Stomach closed. Jejunum reunited. Very little, if any, bleeding at any time from the ulcer. Drainage tract healed promptly. Uneventful convalescence.

*Follow-up report.*—Two years later—quite normal. No further jaundice nor symptoms of recurrence.

*Comment.*—As there was no evidence of a persistent duodenal ulcer, merely abolition of the stoma seemed indicated, and resection of the colon and its mesentery unnecessary. The only innovation in surgical solution of this particular problem was simple cauterization of the completely isolated marginal ulcer still attached to the mesentery, instead of resection. Separation of the stoma from the mesentery of the colon promised to be exceedingly difficult and likely to produce extensive hæmorrhage, the control of which might jeopardize the circulation of the transverse colon; therefore the above expedient was resorted to.

*CASE II.*—Male, aged forty years, admitted August 2, 1931, suffering off and on for fourteen years with symptoms of a duodenal ulcer. In 1927, he was first operated upon and a large ulcer on the posterior wall of the duodenum was found three to four centimetres from the pylorus and adherent to the pancreas. Appendectomy and posterior gastroenterostomy. *Wassermann.*—Negative. He made a normal convalescence and went home on the twelfth day.

Five and one-half months later he had sudden acute excruciating pain, without previous symptoms. Immediate operation revealed a perforated jejunal ulcer in the distal loop of the jejunum two centimetres below the gastroenterostomy stoma. The perforation was closed and covered with omentum. Drainage. Uneventful convalescence.

Six months later he returned with symptoms of gastrojejunal ulcer. He improved rapidly under medical treatment. Refused operation. Two years later he had an operation for post-operative hernia. At this time X-ray showed gastrojejunal ulcer and beginning six-hour retention, but patient again refused further operation. One year later, or three months ago, he had acute intestinal obstruction from adhesions about the old jejunal perforation. These adhesions were released. For five weeks he had acute epigastric and left lumbar pain from which vomiting gave relief, becoming more intense and persistent. Another operation for intestinal obstruction was performed and only a



few adhesions of the transverse colon were found. These were released. Ten days later he came into my hands. He had suddenly begun to vomit huge amounts of brown fluid, 500 to 750 cubic centimetres, with extreme epigastric pain and hard tarry stools. His hæmoglobin was 37 per cent., 6.5 grams per 100 cubic centimetres and his red blood cells were 2,620,000. The X-ray showed large six-hour gastric retention with irregular gastroenterostomy stoma. Occult blood in stools. On a milk diet, with daily lavage and two blood transfusions he improved markedly.

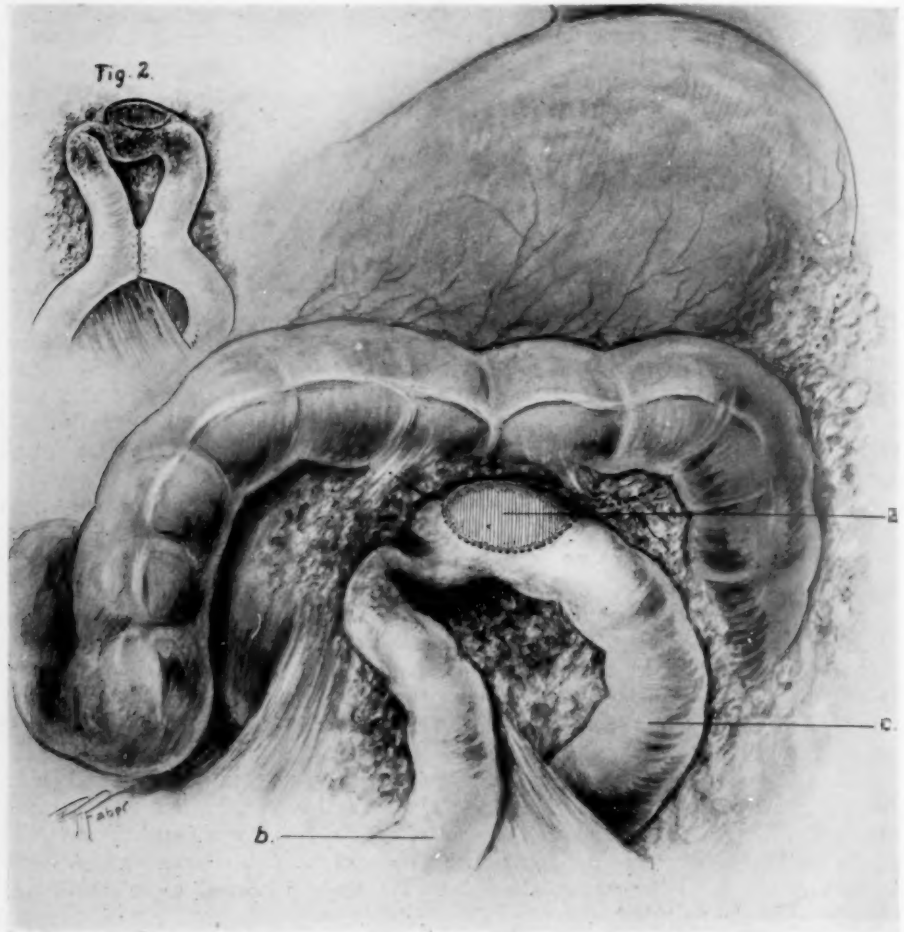


FIG. 1.—(a)—The stoma and gastrojejunal ulcer in Case II, with wide induration about it and showing its proximity to the colon. (b)—The distal loop of jejunum with obstruction and kinking just beyond the stoma. (c)—The dilated proximal jejunum.

FIG. 2.—(Small insert.) The anastomosis of the jejunum around the ulcer.

**Operation.**—August 24, 1931. A huge thickened ulcer around the entire old gastroenterostomy stoma with extreme induration and thickening for fully four centimetres in the mesocolon around it, extending to the base of the mesocolon and pulling the transverse colon down against the ulcer. At the distal margin of the stoma the loop of jejunum just below the enterostomy was firmly adherent to the ulcer, causing a partial obstruction of the jejunum. The proximal jejunal loop was quite dilated. (Fig. 1.) The stomach was greatly distended. Pylorus widely dilated. There was no evidence of duodenal ulcer. There were numerous enlarged glands in the jejunal mesentery. One

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of the jejunal glands was removed for diagnosis and no microscopical evidence of malignancy found. The upper margin of the stoma was first exposed through an opening in the gastrocolic omentum and freed from the stomach with considerable difficulty because of the fixity of the tissues. The opening in the stomach was closed with a double layer of catgut and the stomach side of the stoma was similarly closed, but with considerable tension. The transverse colon was then lifted up and an anastomosis was made between the proximal and distal loops of jejunum six to eight centimetres from the stoma, thus restoring the continuity of the intestine around the obstruction in the jejunum and the ulcer area. (See Fig. 1 insert.) He made an uneventful recovery and went home eighteen days after the operation completely relieved.

*Comment.*—As the patient was still far from a good operative risk when the operation was undertaken, radical resection of the entire ulcerated area seemed out of the question, and the simplest procedure that would relieve the condition found seemed the best surgical procedure to pursue. The jejunum and stomach could not possibly be freed from the mesocolon, therefore the detachment of the stomach from the stoma and an anastomosis of the jejunum around the obstruction was decided upon, leaving the gastrojejunal ulcer really intact, but on a side track of the jejunum only; trusting that when acid gastric juice no longer came in contact with the ulcer it might heal spontaneously.

*Subsequent history.*—He had a normal convalescence for five weeks, when, without any premonitory symptoms, he passed bright clotted blood in stools. He began to have intermittent unlocalized low abdominal pain and severe upper abdominal pain radiating to his back, with marked belching of gas, but no vomiting.

He was re-admitted with marked tenderness in the epigastrium just below the ensiform cartilage. There was no rigidity. His hæmoglobin was 40 per cent., 6.7 grams per 100 cubic centimetres, and his red blood-corpuscles, 3,670,000. The following day he began to vomit bile-tinged fluid at night with severe cramp-like pain in the upper right abdomen, extending to his back, relieved by enema and atropine. There was no further hæmorrhage. X-ray showed a normal emptying stomach with slight irregularity in its middle third and deformity of the duodenum, probably from an old adhesion. The transverse colon was normal. A transfusion was given. It was felt that the gastrojejunal ulcer was still active and an operation for resection was advised.

*At operation,* October 28, 1931, nine weeks after the first operation, it was found that the stomach was slightly distended and lightly adherent to the former operative scars, but otherwise quite normal. The site of the recent jejunal anastomosis was quite free of adhesions and the gut was collapsed. The area of the old gastrojejunal ulcer was difficult to recognize; it was completely healed without a vestige of induration or ulcer (Fig. 3) and fully three to four centimetres of normal mesentery separated it from the transverse colon, which seemed normal throughout. There was, however, a large callous ulcer on the posterior wall of the duodenum, six to seven centimetres in diameter adherent to the pancreas, its proximal margin two centimetres from the pylorus. There were dense adhesions of the gastrohepatic and gastrocolic omenta over the duodenum.

Resection of the ulcer and duodenum and also pylorotomy with closure of the duodenum proximal to the ulcer were considered, but in view of the adhesions and bleeding, character, and size of the ulcer, a two-stage operation was decided upon to give the ulcer an opportunity to heal and make a subsequent resection less formidable. An anterior gastroenterostomy just proximal to the angle of the lesser curvature was then undertaken with entero-anastomosis between the loops. His convalescence was uneventful but he refused further operation.

*Subsequent history.*—He gained thirty-four pounds in two months and felt better than he had for five or six years. He was symptom-free until two weeks ago when he acquired an upper respiratory-tract infection. Since then he has had a little belching of gas, relieved by "baking soda." He has had no melena and no pain.

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*Comment.*—This man evidently belongs to that group in which it has been suspected a constitutional defect or tendency gives a particular liability to the formation of ulcer. He also demonstrates that gastrojejunal ulcer, just as any peptic ulcer under favorable conditions, will readily heal.

**SUMMARY.**—Two cases are reported in which conservative operations

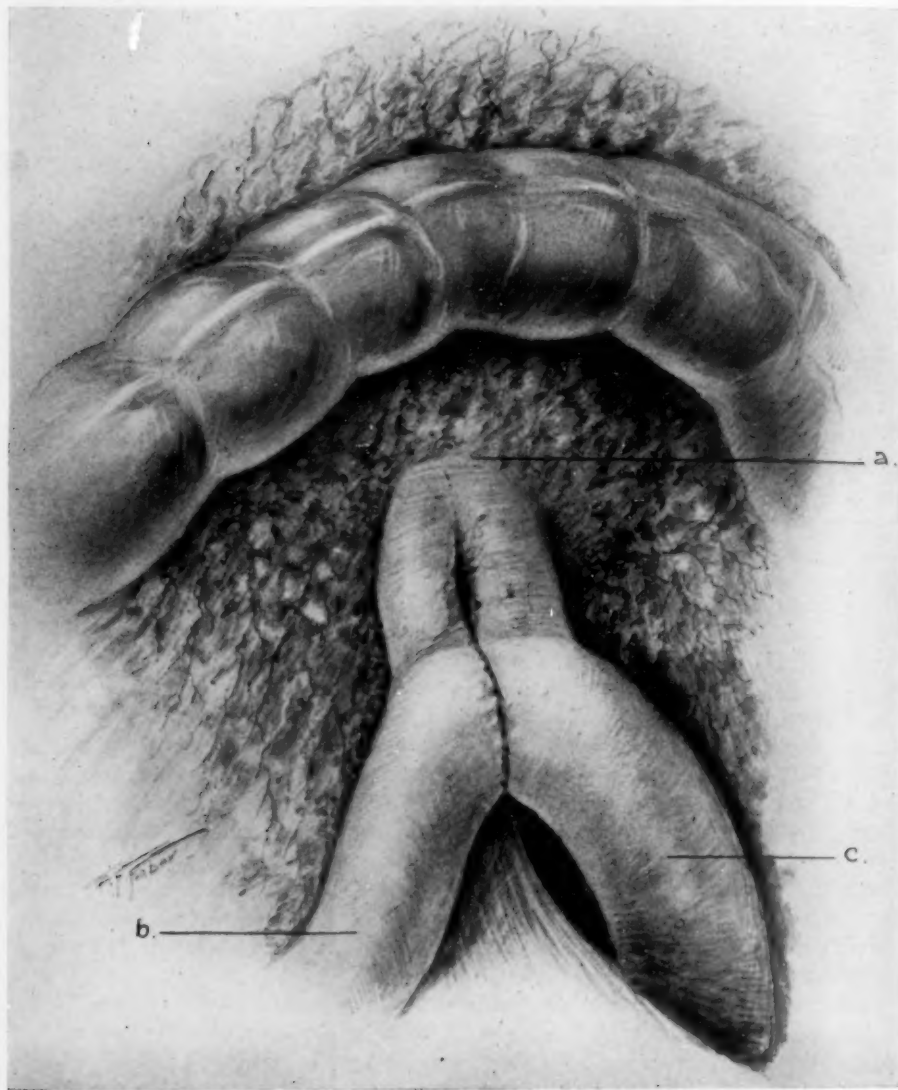


FIG. 3.—(Case II.) The findings at second operation nine weeks after the first. Collapsed "side track" of jejunum with complete healing of gastrojejunal ulcer, no vestige of which remains (a). Note normal mesocolon between colon and former ulcer area. (b) and (c)—Distal and proximal limbs of jejunum.

were used in advanced gastrojejunal ulcer of the slow infiltrating and perforative type. In one case, after detaching and closing the stomach and jejunum, the ulcer still attached to its mesenteric stoma was cauterized. This patient has remained well. In the other, after detaching the stomach from

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the upper border of the stoma and closing it, a jejunojejunostomy around the ulcer area was performed with complete healing of the ulcer within nine weeks as confirmed by a subsequent operation for a recurrent duodenal ulcer. The alternative would have been a preliminary jejunostomy with a later direct attack on the ulcer or an extensive resection, including a portion of the transverse colon. Is it possible that detachment of the stomach from a gastrojejunal stoma yields the opportunity for spontaneous healing of the ulcer?

As Moynihan<sup>16</sup> has said: "The treatment of a peptic jejunal ulcer may be beset with almost insuperable difficulties. Much will depend upon the conditions found at the time of operation." Post-operative mortality for marginal ulcer in the British series as reported by Luff<sup>13</sup> was 33 1/3 per cent. It has likewise repeatedly been reiterated that especially in gastric surgery no one operation or a few favorite operations should be applied universally but that operation should be used which is particularly suitable for the individual case. The above conservative procedures have been recorded as having safely met the special problem encountered in certain particular instances of advanced gastrojejunal ulcer.

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## THE CHOICE OF SURGICAL PROCEDURES FOR DUODENAL ULCER\*

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MY PURPOSE in presenting this material at this time is to direct attention to the fact that duodenal ulcer and its associated pathological lesions differ in proportion among different peoples and in different countries. I refer particularly to specimens of the stomach and duodenum removed primarily for duodenal ulceration in various German surgical clinics, in comparison with those removed at The Mayo Clinic. In April and May of 1931, while on a clinical trip abroad, I had the opportunity to study these fresh specimens and also specimens that had been removed previously.

Konjetzny<sup>11</sup> has published colored photographs and photomicrographs of specimens removed from German patients which show clearly the association of various types of gastritis with duodenal ulcer. These gastric lesions are, for the most part, of the ulcerative type (Fig. 1) and may or may not be associated with additional hæmorrhagic areas of subacute and chronic inflammation. The ulcers are more marked in the region of the lesser curvature, varying in number from a few to as many as twenty or thirty and penetrating to the muscularis mucosæ. Besides the ulcerating type, there is the hæmorrhagic type, in the early stages accompanied by hypertrophy of the mucous membrane. (Fig. 2.) Later this type appears to pass into the atrophic stage of gastritis. (Fig. 3.)

In both groups of cases, it is not uncommon to find fibrinous exudate forming a white membrane spread diffusely over the area of ulceration. In practically all instances, the areas of ulcerative gastritis are confined to the antrum or the lower third of the stomach, whereas the area of hæmorrhagic gastritis, although confined to the antrum in most cases, may occasionally extend to the middle and upper thirds of the stomach. Microscopically, the lesions are characterized by typical areas of ulceration of the mucous membrane, covered in some cases with an exudate composed of fibrin and leucocytes. Marked leucocytic infiltration of all layers of the resected antrum of the stomach is noted. The duodenal ulcers themselves, for the most part, tended to be multiple and seemed larger and more of the penetrating type than those which I have been accustomed to seeing in this country. Konjetzny and his collaborators have pointed out the constant occurrence (up to 100 per cent.) of these gastric changes associated with duodenal ulceration. Lindau and Wulff<sup>12</sup> recently quoted from Konjetzny as follows: "These changes in the mucosa are not secondary conditions of irritation surrounding

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\* Read before the Southeastern Surgical Congress, March 7, 1932.



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the ulcer but are primary or parallel the initial stage of ulceration which is shown by the fact that gastritis is pronounced over the entire pyloric end, irrespective of the site of the ulcer (for example, in the duodenum) and by the fact that this type of gastritis (with clinical symptoms of ulcer) also occurs in cases without any ulcer."

In discussing with surgeons in Germany these associated infectious lesions of the antrum of the stomach, and mentioning their infrequency in association with duodenal ulcer in my experience, the question was raised as to whether at the time of operation for duodenal ulcer, in which pyloroplasty or gastroenterostomy was performed, one could inspect the antrum of the



FIG. 1.—Ulcerative type of gastritis accompanying duodenal ulcer (Schmieden's clinic).

stomach sufficiently to say with any degree of certainty that such associated gastric lesions were not present. I contended that one could make such determinations. This proof I now have. Furthermore, with these gastritis lesions absent in a majority of our cases of duodenal ulcer, it would seem that not only pathologically but biologically the lesions differ in the contrasting groups. Hence surgical procedures directed toward the cure of one group of cases may not be indicated in the other.

The probabilities are that this diffuse inflammation of the stomach, for the most part ulcerative, with its higher incidence among German patients, may explain the higher incidence of recurrence of ulceration following gastroenterostomy or pyloroplasty in contrast to that found in this country. With

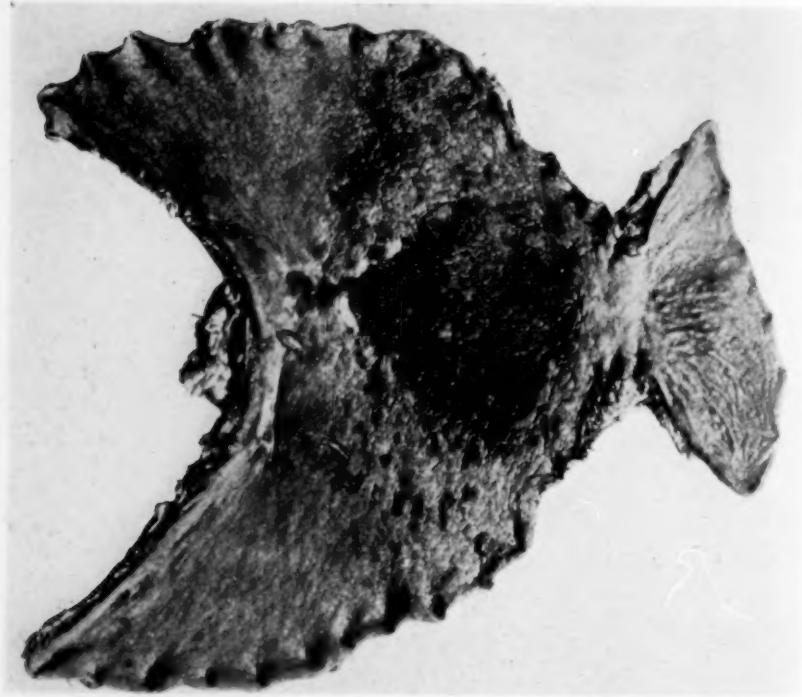


FIG. 3.—Hemorrhagic, atrophic, ulcerative type of gastritis, accompanying duodenal ulcer (Schmieden's clinic).

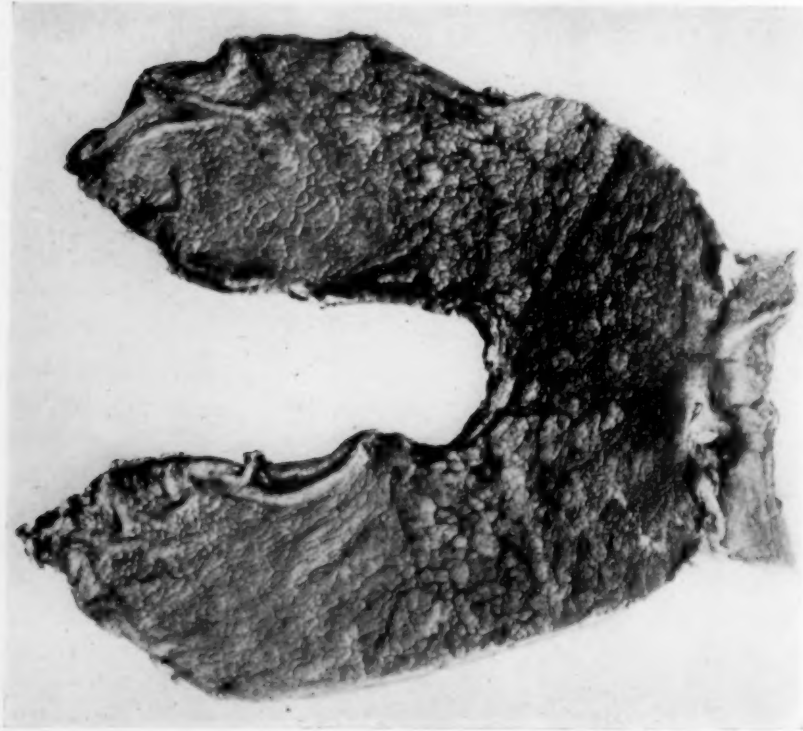


FIG. 2.—Hemorrhagic, hypertrophic, ulcerative gastritis, accompanying duodenal ulcer (Schmieden's clinic).

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a marked degree of subacute, hæmorrhagic and ulcerative gastritis present in the lower portion of the stomach, the stoma made at gastroenterostomy or pyloroplasty is placed in the area of gastritis. Hence it would seem possible that our few cases in which ulcer recurs after gastroenterostomy or pyloroplasty may be of this type, and that recurrence can be prevented if such cases are distinguished from those in which ulcerating gastritis does not coexist.

After returning home, I discussed the question with my colleagues, particularly with Balfour, MacCarty and Robertson, and it was decided that in



FIG. 4.



FIG. 5.

FIG. 4.—Hæmorrhagic, perforating (into pancreas), subacute duodenal ulcer; antrum of stomach shows no gastritis.

FIG. 5.—Resected specimen of stomach for perforated duodenal ulcers, no gastritis.

selected cases in which indications would seem to warrant resection of the stomach, such a procedure would be carried out. I have, therefore, in the last eight months, performed gastric resections of the Billroth I, and posterior Polya types for duodenal ulcer in selected cases, particularly those in which the duodenal ulceration was of the perforating, hæmorrhagic, or craterous type. (Figs. 4 and 5.) In only two of the specimens was gastritis associated; in one of them, the presence of the gastric ulcerations had been demonstrated in röntgenograms prior to operation (Figs. 6 and 7) whereas in the other, the presence of the ulceration was evidenced by the unusual thickening and congestion of the lower portion of the stomach to palpation. (Fig. 8.) This patient had had two severe hæmorrhages from the ulcer or

ulcers. In both cases necessity for gastric and duodenal resection was apparent because of the multiplicity of the lesions. With the exception of these two cases, there was no evidence of either the ulcerative or hæmorrhagic type of gastritis associated with duodenal ulcer.

In two other cases in which resections of the stomach were done for gastrojejunal ulcer, gastritis was evident, with one small superficial ulcer in one case.

That essential differences in other types of pathological lesions exist in different countries, or, indeed, in different parts of the same country, is apparent when one studies the distribution of cases of enlargement of the thyroid gland. We are all acquainted with the so-called "goitre belts" in

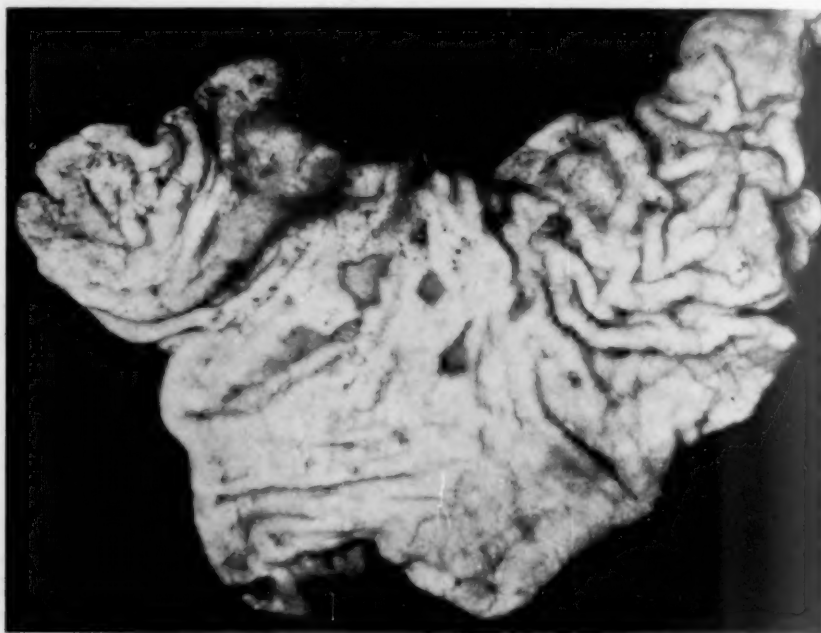


FIG. 6.—Duodenal ulcers with ulcerating gastritis (diagnosed pre-operatively by Röntgen-ray).

this country in which the thyroid gland is excessively enlarged. Likewise, the incidence of associated hyperthyroidism is variable geographically. In Germany, in the mountainous regions near the source of the Rhine, there are said to be but few cases of exophthalmic goitre, which is in direct contrast to the proportion of goitre existing in the northern provinces of Germany along the same river. Certain surgeons<sup>9</sup> have noticed that there is a marked difference in the types of duodenal ulcer and the degree of associated gastritis in two cities along the Rhine only sixty miles apart. This geographical variability is more striking when one considers that in duodenal ulcer and its associated lesions, the lesion is accompanied by an oversecretion. Further evidence of the geographical variability, possibly associated changes of metabolism, is the increasing development of calculi in the urinary tract which

SURGERY OF DUODENAL ULCER

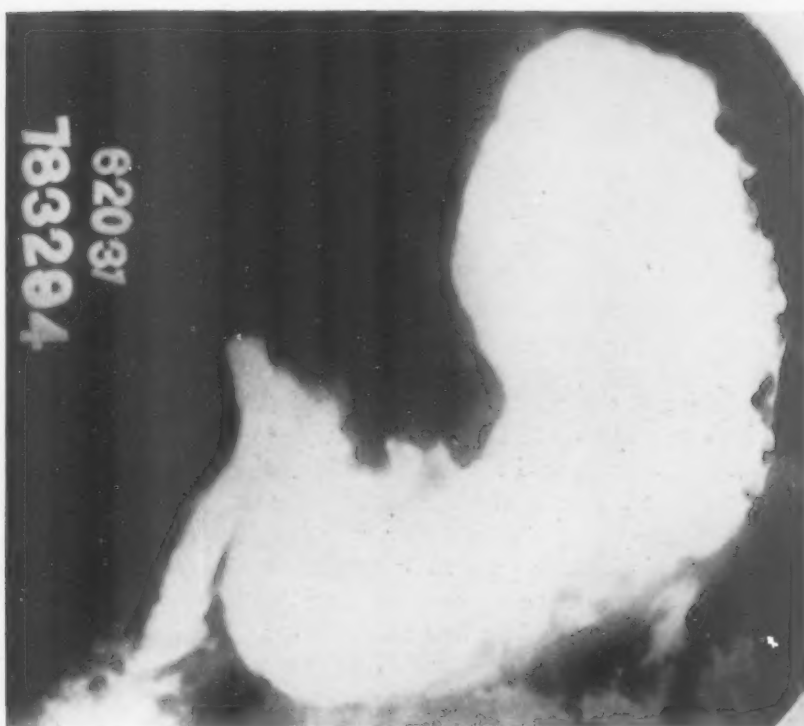


FIG. 7.—Pre-operative roentgenogram.



FIG. 8.—Hemorrhagic duodenal ulcers with ulcerating gastritis.



has occurred in almost geometrical progression in some parts of Germany during the last ten years. For the most part, these urinary calculi exist without urinary infection, and the similarity of their percentage of development in relation to that of exophthalmic goitre in the various provinces around the Rhine, as noted by Braun, is striking in that where exophthalmic goitre has been infrequent in appearance, so has the frequency of urinary calculi been less. Further, during this same period of ten years, there has been an alarming increase in the proportion of fatal post-operative pulmonary emboli in the German-speaking countries; this increase has not occurred in some of the surgical clinics in Paris with which I am acquainted, nor has it occurred in the clinics in the United States. I have felt for a considerable period that the incidence of post-operative pulmonary embolism has a distinct relationship to metabolism, and the recent work of Bancroft and Stanley-Brown<sup>5</sup> would seem to indicate that a diet high in protein tends to increase the clotting time of the blood. These facts, I believe, will add additional weight to my argument that the lesions associated with duodenal ulcer vary in different localities and among different people.

Before considering the part the presence or absence of inflammatory lesions of the antrum of the stomach associated with duodenal ulcers should play in the determination of the best surgical procedure, I should like briefly to consider the non-surgical methods of treatment of duodenal ulcer.

There seems to be little doubt that in the majority of cases, acute duodenal ulcer, with mild symptoms of short duration, can be adequately controlled by proper maintenance of the relationship between diet, habits, and neutralization of gastric acidity. The patient with chronic duodenal or gastric ulcer, however, who has failed to respond to non-surgical methods of treatment, producing symptoms interfering with the proper carrying out of the patient's work or other activities, should be treated surgically. Such being the case, the earlier a proper surgical procedure is carried out in indicated cases, the sooner the patient can return to full work.

I am rather of the opinion that during the last few years, more credit has been given to the so-called medical treatment of chronic duodenal ulcer than is justly due it. This has not been entirely the result of the enthusiasm of the internist and the gastroenterologist. I think that the tendency of German surgeons to favor partial gastrectomy, and its adoption by a few surgeons in this country as a routine procedure for cases of duodenal ulcer without recognition of variable pathological changes, have obscured the fact that excellent results are obtained in 90 per cent. of cases in this country in which conservative surgical procedures are adopted. Such conservative procedures are gastroenterostomy or pyloroplasty, with excision of the duodenal ulcer, which one should be able to carry out with an operative risk of mortality of approximately 1 per cent.

Quoting from a paper by Urban Maes<sup>17</sup> on "The status of surgery for peptic ulcer; impressions gained from the 1930 symposium of the American Surgical Association": "Gastroenterostomy gives excellent results for duo-

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denal ulcer and only slightly less good results for gastric ulcer. It is abused and it has its percentage of failures, but these facts are no warrant for the routine performance of the difficult and dangerous operation of gastrectomy for all peptic ulcers. Partial or subtotal gastrectomy, even in the most skillful hands, has a higher mortality than gastroenterostomy in an equal percentage of subsequent marginal ulcers."

In considering the place of gastroenterostomy in the treatment of duodenal ulcer, I should like to call attention to a series of three articles which appeared in the *British Medical Journal* in the latter part of 1929 and the first part of 1930, written by Dr. Arthur P. Luff,<sup>14, 15, 16</sup> Consulting Physician and Director of Research, St. Mary's Hospital, London. These papers were based on a collective investigation carried out by the British Medical Association, consisting of inquiry into the after-history of patients who had been submitted to gastroenterostomy in 1920 to 1924, inclusive. Reports of 2,609 cases were received in response to the inquiry; 995 of the cases were of duodenal ulcer. The results of gastroenterostomy were reported as being very satisfactory in 89.5 per cent. of the cases. General improvement in health and well-being occurred in all but a few; secondary gastrojejunal ulcer occurred in 2.8 per cent. of the cases, and secondary hæmorrhage in 2.4 per cent., but with no fatal results. These results are practically identical with those of Balfour,<sup>1, 2, 3, 4</sup> Moynihan,<sup>18</sup> Walton<sup>21</sup> and Gosset.<sup>8</sup>

In a symposium of the American Surgical Association, 464 cases were reported, in which pyloroplasty, with excision of the duodenal ulcer, was performed at The Mayo Clinic. Judd<sup>10</sup> reported satisfactory results in 90 per cent. of these cases. The risk of the operative procedure was less than 1 per cent., and the operation was applicable in 50 per cent. of the cases of duodenal ulcer. A similar good record was that of Finney and Hanrahan,<sup>7</sup> who reported 251 cases, in which pyloroplasty, with excision of the ulcer, was carried out with satisfactory results in 86 per cent. of the cases.

Should subacute or ulcerative gastritis involve the lower third of the stomach in association with duodenal ulcer, it would seem that the type of lesion must be entirely different, not only pathologically, but also biologically, and resection of the ulcerated portion of the stomach and duodenum must be considered. It should be remembered, however, that the average risk of partial gastrectomy, including partial duodenectomy, with removal of the duodenal ulcer varies from 5 to 10 per cent. in the hands of the most skillful and experienced surgeons, and that this risk increases proportionately to from 13 to 15 per cent., as reported from a European clinic,<sup>6</sup> depending on the size, fixation, and degree of penetration and the extent of the resection of the duodenum necessary to remove it.

There is not a great deal of difficulty in performing gastric or duodenal resection when the duodenum can be mobilized easily and the duodenal ulcer has not perforated into the surrounding structures. On the other hand, if the duodenum cannot be readily mobilized, and if the lesion has penetrated into the surrounding structures, its removal would seem to carry an unwar-

rantable risk, particularly in view of the fact that a properly placed normally functioning gastroenteric stoma with an average risk of probably not more than 1 per cent., would give as great an incidence of relief of the symptoms and cure of the ulcer.

I was convinced that for surgeons operating in Germany, gastric resection was the most rational surgical procedure, especially the Billroth I type, in which the areas of ulceration of the duodenum and stomach are removed and the stomach and duodenum approximated by an end-to-end anastomosis. On the other hand, the infrequency with which such accompanying inflammations in the stomach have been present in patients operated on by me at The Mayo Clinic in the last eight years has led me to believe that in far the majority of the cases, excellent results can be expected by the conservative operation of gastroenterostomy or pyloroplasty with excision of the ulcer. These procedures can be carried out with minimal risk. Should associated inflammatory changes, especially those accompanied by ulcerations of the stomach, exist in connection with duodenal ulcer, I believe there is a place for removal of the ulcerating portion of the duodenum and stomach. This particularly applies to the bleeding type of ulcer.

I would fail in my duty after advocating such an operative procedure, if I did not direct attention to the fact that in the German surgical clinics, where subtotal gastrectomy for duodenal ulcer and its associated gastric lesions is for the most part routine, excellent results are obtained in from 80 to 85 per cent. of their cases. The 15 to 20 per cent. of cases in which there has been failure to secure excellent results were attributed by Henning to the fact that gastritis also existed in the portion of the stomach remaining after gastric resection. This was proved by gastroscopical examination. Starlinger,<sup>20</sup> following a statistical study of the post-operative results of gastric resection for duodenal ulcer and its associated gastritis, in 26,000 cases in which operation was performed at the various German surgical clinics, reported an incidence of recurring ulceration developing in from 0.6 to 1 per cent. of the cases.

The indications for various operative procedures in the treatment of duodenal ulcer, therefore, might be said to be as follows: When the duodenal ulcer is of large size and of the penetrating type, with fixation to the surrounding structures and with lack of mobility of the duodenum, and when its complete removal, with adequate closure and anastomosis of the duodenum, is difficult, gastroenterostomy is the indicated procedure. When the duodenal lesion or lesions are accessible, when the duodenum is easily mobilizable, and when gastritis is absent, excision of the duodenal ulcer or ulcers and of a portion of the pyloric sphincter gives excellent results in 90 per cent. of the cases. Resection of the stomach, or subtotal gastrectomy, has a place in removal of ulcerating lesions of the duodenum, if these are accompanied by ulcerating or hæmorrhagic gastritis, which is confined to the antral portion of the stomach.

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### SUMMARY

Portions of the stomach and duodenum, resected for duodenal ulceration, in some of the German surgical clinics, are contrasted with portions removed at The Mayo Clinic. In the lesions removed at the German surgical clinics, there was found marked associated gastritis. These gastric lesions are for the most part ulcerative in type, are confined to the antrum of the stomach, and are either associated, or not, with hæmorrhagic gastritis and hypertrophy or atrophy of the mucous membrane. Konjetzny has found gastritis to be an accompaniment of duodenal ulcer in practically all such resected specimens. In a study of the antrum of the stomach in cases of duodenal ulcer in which operation was performed at The Mayo Clinic the very infrequent association of gastritis is noted, evidence being presented by specimens removed at the time of operation.

It will stand to reason, therefore, that not only pathologically but biologically, the lesions in the two countries differ, hence the surgical procedures directed toward the treatment of one group of cases may not be indicated in the other. The probabilities are that the gastritis associated with duodenal ulcer in Germany accounts for the higher incidence of recurrence of ulceration following the conservative operations of gastroenterostomy and pyloroplasty in contrast to the low incidence of recurrence in this country. It would seem possible that the explanation for the development of recurring ulcer in the few cases (approximately 2.5 per cent.) in which it is seen, after gastroenterostomy and pyloroplasty, might be that in such cases there were associated inflammatory changes in the stomach. This small incidence of recurrence might be prevented if such cases were distinguished from those in which no ulcerative gastritis coexists. In two of our cases, associated ulcerating lesions of the stomach were known to exist. In one case they were demonstrated röntgenologically, and in the other there was palpable evidence of thickening and congestion in the lower end of the stomach. In substantiating the idea that variability in pathological lesions exists in different geographical regions, attention is directed to the variability in the incidence of toxic goitre, urinary calculi and post-operative pulmonary emboli in different parts of the world.

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## TUMORS OF THE SMALL INTESTINE \*

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TUMORS of the small intestine are unusual. Compared to the frequency with which growths are found in the large bowel they are rare. It seems remarkable that with cancer of the stomach so prevalent, the alimentary canal, from the pylorus to the ileo-cæcal valve, would not likewise be a frequent site for primary malignant growths. Yet there are surgeons of considerable experience who have never operated upon a benign or malignant tumor of the small intestine.

The records of the Johns Hopkins Hospital<sup>1</sup> reveal eighty-two cases of primary tumors between the pylorus and ileo-cæcal valve, fifty were malignant, thirty benign; a 6.5 percentage of all tumors in the gastro-intestinal tract. At the Boston City Hospital Mallory<sup>2</sup> reported eleven cases found in 4165 post-mortems. Kenneth Patterson,<sup>3</sup> in 1929, by a careful search in the files of the Massachusetts General Hospital from 1894 to 1929 discovered forty-five cases of small intestinal tumors proven such by operation or autopsy. At the Roosevelt Hospital over a period of twenty-one years (1911-1932) we have had fourteen tumors of the small intestine. One other I operated upon in a private hospital. In the study of these fifteen cases, it was learned that unfortunately our immediate results were anything but satisfactory; our diagnosis inaccurate; our operative mortality high. We have made a careful analysis of these cases, to see wherein the diagnosis could be made more certain and our operative mortality lessened. Growths of the ampulla of Vater have not been included. Although about 70 per cent. of cancers of the duodenum begin in the peri-ampullary portion, we feel that at operation and even at the post-mortem table it is difficult to be certain that the tumor arises from the true ampulla, or whether it originates in the lower end of the common bile-duct or from aberrant pancreatic acini in the wall of the common duct or even from cells lining the pancreatic duct at its lower end. We have also excluded growths at the ileo-cæcal valve, for here again it is often confusing to determine the tumor's exact origin.

They occur at any age. In our series the ages ranged from four years to seventy-one.

More frequent in males than in females; the proportion is more than two to one.

*Pathology.—Benign tumors.*—Included in the group of benign tumors of the small intestine are: Those of the chronic inflammatory type, lipomas, myomas, adenomas, carcinoid or "argentaffin tumors so-called," hemangi-

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omas, fibromas, pancreatic rests, hematomas and cysts. In our series there were two adenomas, one leiomyoma, one chronic infective granuloma, one fibroma and one case of pancreatic rest. They may develop as intraluminal or extraluminal growths. The internal tumors arise in the various layers of the bowel wall; usually benign; they grow into the lumen. They are either pedunculated or flat; grow slowly and cause few or no symptoms until they reach a size sufficient to produce obstruction or to evoke an incipient intussusception. Those developing externally arise from the serosal surface and protrude into the peritoneal cavity or, in some instances, directly into the mesentery, becoming fairly well fixed in this situation; some become the size of a foetal head lying free in the peritoneal cavity, others become firmly adherent to and involve adjacent viscera.

Another distinctive form which avoids development outwardly or inwardly are those encircling the lumen, infiltrating uniformly all coats of the intestine; chronic inflammatory lesions fall into this category, but are distinctive in that they spread continuously, in the longitudinal direction of the bowel wall; our case of chronic infective granuloma (Case IV) is a striking example of how much constriction can be produced.

The fibromata are rare. In size they vary from the dimensions of a large pea to a lemon. They have their origin in any layer of the intestinal wall, containing fibrous tissue. If pedunculated and large enough they may cause intussusception or obstruction due to blocking of the lumen. The extraluminal fibromata grow to considerable size. They are found with equal frequency in duodenum, jejunum and ileum. Our single case (Case III) of fibroma was in a woman, operated upon as an emergency for acute ileus. A fibroma  $1\frac{1}{2}$  inches in diameter, of the ileum, had caused an intussusception.

The myomas are prone to bleed; in fact, severe hæmorrhages have been encountered, sufficient to endanger life, and even fatalities have been reported. Goldschmidt<sup>4</sup> reports a man forty-one years of age, having severe intestinal bleeding, collapsed on one occasion, tumor mass palpable in lower abdomen. Operation revealed a tumor of the jejunum, the size of a man's two fists, arising from the anti-mesenteric border; the greater part of the highly vascularized mass lay in the free peritoneal cavity adherent to the urinary bladder. Histological examination disclosed a leiomyoma.

Our case (Case V) of leiomyoma of the jejunum had four sharp hæmorrhages, his first sufficient to produce immediate unconsciousness, while preaching from a pulpit.

The adenomata are common; single as a rule, sometimes multiple. Small, generally sessile, if pedunculated, they frequently are the cause of intussusception. They originate in the epithelium of the intestinal glands. Many are found in autopsy reports. We report two in our series; one (Case II) a small tumor, 2.5 by 3 by 2 centimetres, of the ileum producing an intussusception. The other (Case I) of the duodenum, 1 centimetre in diameter, sessile in type.

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An unusually interesting group of tumors of the small intestine and appendix are the so-called argentaffin tumors formerly termed "carcinoids"; certain granules in their cells show a marked affinity for silver. Repeatedly confused with carcinomas, their exact nature is not thoroughly understood. They occur singly; often multiple, giving rise as a rule, to symptoms of acute or chronic ileus. Small, sessile or pedunculated, they grow slowly and metastasize rarely. In the appendix they are often overlooked when examined grossly, for they appear as minute nodules embedded in the mucosa. Mason<sup>5</sup> discovered in 1928 that these tumors arose from the argentaffin cells of the intestine. Forbus<sup>6</sup> reported six cases and called particular attention to the harmless character of these tumors.

On account of malignant degeneration of accessory pancreatic tissue, this group is of surgical importance. These rests occur in the stomach, duodenum, jejunum, ileum, folds of the mesentery and colon; and in the wall of the gall-bladder. The nodules, usually about 1 centimetre in diameter, contain pancreatic ducts, acini and islands of Langerhans. Intussusception may result, or bands of adhesions may form from the nodule to a neighboring loop of intestine causing an ileus.

Branham<sup>7</sup> reports a pyloric growth involving the stomach wall, as well as the first portion of the duodenum. Pylorectomy. Dr. W. H. Welch diagnosed the tumor as cancer originating in aberrant pancreatic cells.

Recently Bookman<sup>8</sup> reports another carcinoma of the duodenum secondary to pancreatic rests in the first portion of the duodenum, occurring in a young woman twenty-seven years of age. In our own series (Case VI) accessory pancreatic tissue was found in a woman of sixty-four, who had complained of pain in the right upper quadrant of the abdomen; the eating of meat increased the symptoms. A small, one-centimetre in diameter, elevated, rounded mass of accessory pancreatic tissue was found in the duodenum just to the right of the pyloric ring, which proved to be benign.

Hemangiomas are rarely found reported in the literature. Carmen<sup>9</sup> in 1921 describes one just to the right of the pyloric ring; a sessile tumor 4 by 5 centimetres casting a rounded area of diminished density in the barium-filled duodenal cap suggesting a polyp.

In 1923 Waugh<sup>10</sup> reported a case of congenital cyst of the duodenum in a baby nineteen days old.

*Malignant tumors.—Carcinoma.*—There are various forms of small intestinal cancer. Ewing<sup>11</sup> describes them as: First, part of a local or general intestinal polyposis. Second, multiple or single, embryonal carcinoid tumors; single or multiple usually in the jejunum or ileum. Third, localized adenocarcinomata; this latter type represents the majority of carcinomata of the small bowel. Of all neoplasms of the small intestine carcinoma is the one most frequently found; yet they comprise only 3 per cent. of cancers of the entire intestinal tract. Combining two reports from the Mayo Clinic, one by Judd,<sup>12</sup> in 1919, and another by Rankin and Mayo,<sup>13</sup> in 1930, there are recorded fifty-five cases of malignancy in the small bowel; during this same

period of time, there were 4597 cases of carcinoma of the large intestine and rectum, and 4335 cases of cancer of the stomach. They occur more often in the duodenum and ileum than in the jejunum. Judd and others feel that carcinoma arising in the bed of an ulcer is uncommon. In the duodenum they are found more often in the middle portion, next in the first portion, and frequently in the third portion. In the third or infra-ampullary part, they usually form a constricting type of growth; and when the duodenum is markedly dilated, annular tumor in this segment should be suspected. In the jejunum and ileum they exist as an annular growth or as a fungoid tumor. Some invade the outer coats and develop free in the peritoneal cavity.

Metastasis is common in carcinoma of the small intestine, usually involving liver, lungs, mesentery and peritoneum.

Of our fifteen cases of small-bowel neoplasms, there were six carcinomata, five found at operation and one discovered at autopsy in a woman who died shortly after admission to the hospital, without operation. Two in the duodenum, one in the jejunum, three in the ileum.

*Sarcoma.*—Sarcoma of the small intestine is less frequently found than carcinoma. Generally they are single and usually found in the ileum. The spindle-cell type, generally small and pedunculated, is rare. If obstruction occurs, which is not often, it is "due to growths in the mesentery or to kinks or adhesions of the intestine."<sup>14</sup> There are three types of sarcomas: (1)—A growth from the peritoneal surface of the bowel wall; exceedingly rare, likely to cause acute torsion of the bowel wall. They occasionally grow to be quite large. (2)—A small polypoid mass projecting into the lumen of the bowel; this is the most common type; many months of colicky pains, fever, cachexia and finally ileus due to intussusception. (3)—A flattened extensive infiltration of the wall of the intestine. Usually palpated in the abdomen as an appendiceal abscess, carcinoma of the colon, or a twisted ovarian cyst. Involvement of adjacent glands and metastatic dissemination are not constant sequelae. One (Case XV) of our patients was a boy four years of age, with a lympho-sarcoma of the ileum, the tumor mass measuring 5 by 7 centimetres. Another (Case XIV), a man, age not given, with a lympho-sarcoma of the ileum, causing intussusception, through the ileo-caecal valve.

Liu<sup>15</sup> classifies sarcomata under the general heading of lymphoid-cell or granulation-tissue tumors, along with lymphosarcoma and round-cell sarcoma; he includes also chronic inflammatory tumors, intestinal Hodgkin's disease, granulomatous pseudoleukæmia or lymphoblastoma. They are all round-cell tumors, arising from lymphoid nodules in the submucosa of the intestinal wall. Grossly they may have the appearance of a polyp or conform to the annular type. Their characteristic features histologically are: (1)—They are new growths composed of unusually large round cells in various shapes and sizes. (2)—Even larger cells containing two or three nuclei are found. (3)—Mitotic figures are common. (4)—The growths arise in the submucosa, invade the mucosa on one side and the muscularis on the other. Ulceration is not infrequent.

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*Symptoms and signs.*—We realize that few deductions can be drawn from so small a number of cases. But from these and others reported we are convinced that early, accurate diagnosis depends upon a thorough evaluation of the earliest symptoms—those vague and mild complaints, present intermittently for months and even years, which the patient frequently considers insignificant.

Early symptoms are slight. It is with some difficulty that patients remember the mild colicky twinges or variations in the character of their stools after the onset of severe pain, genuine abdominal discomfort and loss of weight. In going back carefully through our case histories and in talking to patients after the operation, we have found that early symptoms were present, and in some instances, no doubt, if properly analyzed would have led to a timely and perhaps correct diagnosis. One patient (Case V) with the bleeding Myoma took some months after his recovery to recollect that two years preceding his first hæmorrhage, he had been treated for a so-called mucous colitis. Another (Case XI), with a carcinoma of the duodenum, for six years had taken huge doses of soda bicarbonate for indigestion. She and two members of her family denied that this could have been connected with her present severe pain, nausea and vomiting. Still another (Case XII) with an annular carcinoma of the terminal ileum producing chronic obstruction, was emphatic that her difficulty began two years previously, with attacks of pain at intervals of every six weeks, generally in the right lower quadrant accompanied by nausea and vomiting, yet her husband was equally emphatic that she had complained of lower abdominal distress for a full six months prior to her frank attacks.

The earliest symptoms are frequently indefinite and even the latter ones are difficult to classify until the diagnosis is fairly apparent, as when a mass is palpable, or the X-ray warns of an impending obstruction. In general, the symptoms depend upon the site of the neoplasm, whether intra- or extra-luminal; its size, whether annular, sessile or infiltrating; and to whether it be malignant or benign. To correctly analyze the symptoms seems of prime importance, for the X-rays although frequently helpful are not infallible and thus we must primarily depend upon accurate estimation of symptoms for early diagnosis.

Benign tumors give rise usually to symptoms which are different from those of malignant tumors. If the tumor is benign and small no symptoms will be complained of; the majority of such tumors are found accidentally at operation for another condition or at the autopsy table. Sometimes good-sized tumors on the serosal surface give no symptoms. Those benign tumors arising from the mucosa and projecting into the lumen, that are of good size, may produce severe hæmorrhage, intestinal obstruction and often intussusception. Of Raiford's eighty-two cases 37 per cent. gave symptoms sufficient to demand operation; 17 per cent. gave symptoms of such uncertain nature that they were not operated upon and the tumor was found at autopsy;



46 per cent. gave no symptoms and the growth was discovered accidentally at post-mortem.

Neoplasms of the duodenum cause symptoms different from those of the jejunum and ileum. In those of the duodenum the pain is usually in the epigastrium, easily confused with the pain associated with duodenal ulcer; if malignancy exists the pain is often constant; in the jejunum and ileum it is likely to be painless until intussusception or obstruction intervenes. Accompanying the severe, colicky pain of the impending obstruction, or the sharp, constant pain of intussusception, nausea is a frequent symptom, transient in the incipency of the disorder it goes hand in hand with so-called indigestion, heartburn and eructation. Nausea and vomiting were prominent symptoms in 50 per cent. of our cases, regardless of in which portion of the bowel the tumor was situated. Vomiting does not take place prominently until a benign, pedunculated growth or even a fungoid, malignant one incites a beginning intussusception; a constricting growth high up in the jejunum or in the duodenum causes early vomiting. Loss of weight was complained of in eight of our fifteen cases; pronounced in the malignant growths, it was accompanied by anæmia and cachexia. Blood in the stools occurs not until late, usually after ulceration has taken place. Bleeding varies from small amounts not constantly detected to massive hæmorrhages, sufficient to almost totally incapacitate. It may be the only symptom of the disease, as in our case (Case V). Jaundice is suggestive in those cases occurring in the ampullary segment of the duodenum. It occurred in one instance in our series where the growth was proximal to the ampulla, yet coexisting œdema was sufficient to close the infraduodenal portion of the common bile-duct. Increased peritoneal fluid is a sign to be watched for where malignancy is suspected. "Cancer of the ileum gives rise to no signs which render the localization of the disease a matter of certainty."<sup>16</sup>

It seems purposeful to emphasize vague abdominal discomfort in a person of any age, who tires easily, with loss of appetite, loss of weight, whose bowels are irregular, either becoming increasingly constipated or alternating attacks of diarrhoea and constipation.

*Röntgenography.*—Repeated X-ray examinations considered with the clinical findings sometimes prove a valuable aid in diagnosis. It must be emphasized that negative findings do not exclude the presence of a tumor. In our patient with the leiomyoma of the jejunum, who almost had a fatal outcome from severe hæmorrhages, repeated complete gastro-intestinal series, four in all, failed to show anything, except in the last series we held tenaciously to a constant defect in the second portion of the duodenum, which was diagnosed a bleeding diverticulum; when we located the myoma well down in the jejunum we then knew how pitifully we had clung to an artefact.

The X-ray diagnosis of tumors of the duodenum is difficult, for the barium proceeds rapidly through the duodenum; unless the tumor is of large size, it is seldom visualized; however, if a "vacuole" is constant in the bulb

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the presence of a tumor originating in the duodenum is suggested; however, if there is an accompanying six-hour gastric retention, a growth arising in the stomach and prolapsing into the duodenum must be excluded.

Pre-operative diagnosis of tumors, that of the jejunum and ileum, by röntgenographic methods is even more difficult than that of the duodenum. Generally it fails to prove the presence of a tumor and can only be of assistance by demonstrating a localized narrowing of the lumen or portraying shadows pathognomonic of obstruction. Plates taken with the patient in the erect posture is universally practised, in attempting to locate these tumors.

The reason for so few X-ray reports in our cases, is, no doubt, due to the fact that many necessitated immediate surgery, or if not operated upon almost at once, impending obstruction ruled out this diagnostic aid.

*Treatment.*—It is agreed that all tumors of the small intestine should be managed surgically. When there is no obstruction present, resection with end-to-end suture or lateral anastomosis according to the individual surgeon's liking and ability is indicated. Should even a mild degree of obstruction be present, a side tracking two-stage procedure is sometimes wise; for, as has been repeatedly shown, a one-stage operation has proven hazardous. Especially is this true in the terminal ileum. The jejunum offers the most accessible and least dangerous portion of the small bowel to be resected.

At operation syphilitic strictures or nodules which are secondary to growths of some other viscera may prove confusing. It is impossible at times to differentiate between a tuberculous and a cancerous lesion. Numerous incidences are recorded where definite inflammatory lesions of the small bowel at operation could not be differentiated from new growths. If the slightest doubt exists resection is justified.

In our group eight primary resections were done with five side-to-side anastomoses, and three end-to-end sutures. One local excision of an adenoma of the duodenum; one local excision of a pancreatic rest; one ileo-colostomy succumbed the fifth day post-operative; one anterior gastroenterostomy with a Murphy button, short-circuiting an advanced carcinoma of the jejunum. One posterior gastroenterostomy for annular growth of second portion of duodenum. One exploratory celiotomy.

*Prognosis.*—The prognosis is particularly unfavorable in malignancy of the small bowel. It is less favorable than following operation for cancer of the stomach and large intestine. In the benign group the prognosis is good. It is a fact that whether young or old, a patient with a malignant tumor of the small intestine lives only a few years even though an apparently early and complete resection has been done.

*Results.*—Of the fifteen patients operated upon, five died within eight days after operation; a high operative mortality.

In those patients with benign tumors of the intestine our results were excellent, except for the case of chronic ulcerative granuloma who died at his home one month later from lobar pneumonia. The patient with the

bleeding leiomyoma of the jejunum made a splendid recovery, was seen one month ago, has gained tremendously in weight, is active and in excellent condition.

Of the six carcinoma cases: One died of shock seven hours post-operative; one died sixteen hours after admission to the hospital without operation. One died on the third day post-operative, of peritonitis. In this case there were multiple carcinomata in the last four feet of the terminal ileum; ileocolostomy proved unsuccessful. One died on the eighth day post-operative, of peritonitis. With this patient, I believe the two-stage procedure would have ended differently, as she was partially obstructed. Another patient with a constricting duodenum above the ampulla died three months after gastroenterostomy had been performed; inanition, anaemia, liver metastasis were the autopsy findings in this case. Our one case of Hodgkin's disease of the intestine died two months after being discharged from the hospital, probably a metastatic death. Of our two cases of sarcoma of the ileum, one died nine hours post-operative, of shock; this patient was partially obstructed at the time of admission; immediate resection with end-to-end suture was attempted. The other case of sarcoma of the terminal ileum with an intussusception was discharged from the hospital improved. This patient probably died shortly afterwards.

Four of our operative cases that died within eight days after operation entered the hospital with either partial or complete obstruction.

#### CONCLUSIONS

- (1) Tumors of the small intestine are of sufficient rarity to warrant reporting of cases.
- (2) They occur at any age; more common in males than in females.
- (3) Intraluminal benign tumors frequently cause intussusception.
- (4) Accurate diagnosis depends upon sound evaluation of the earliest symptoms—those often considered insignificant by the patient. Röntgenography is rapidly becoming a more reliable and dependable aid in localizing these tumors.
- (5) Poorly formed bowel movement, malaise, unusual intermittent twinges in the abdomen are frequently the earliest symptoms.
- (6) Those tumors that bleed produce a marked secondary anaemia; at times sharp hæmorrhages may incapacitate; occasionally prove fatal.
- (7) Any easily movable mass in the abdomen should be early eliminated as a tumor of the small bowel.
- (8) Immediate resection with removal of gland-bearing area is indicated, unless obstruction is present; then a two-stage procedure is preferable.
- (9) Four of our operative cases that died within eight days after operation entered the hospital with either a partial or complete obstruction.
- (10) In benign tumors the prognosis is good. It is particularly unfavorable in the malignant group.

## TUMORS OF SMALL INTESTINE

### RÉSUMÉ OF OUR FIFTEEN CASE HISTORIES

CASE I.—(R. H. No. B 1326, Path. No. not given.) Date of operation, February 2, 1911. A man (age not stated) complaining of constant dull pain in epigastrium and right hypochondrium for a period of three months. Other than complaint, nothing of



FIG. 1.—Case II. Specimen of a portion of the ileum measuring 20 by 5 by 5 centimetres arrows indicating a small intra-luminal adenoma measuring 2.5 by 3 by 2 centimetres, which was the cause of the intussusception.

importance in history. *Physical examination*.—Negative. (No report of X-ray having been taken.) *Pre-operative diagnosis*.—Duodenal ulcer or cholecystitis. *Operation*.—Local excision of tumor. *Diagnosis*.—Adenoma of duodenum (anterior wall.) *Patho-*

*logical report.*—Specimen consists of tissue 1 centimetre in diameter. One surface covered entirely with mucous membrane showing an area of ulceration. Beneath muscularis mucosa a considerable mass of gland tissue forming an adenoma. *Microscopic diagnosis.*—Adenoma of duodenum.

CASE II.—(R. H. No. A 19311, Path. No. S.B. 195.) Date of operation, March 31, 1922. A man, aged twenty-seven years, complaining of attacks of severe epigastric pain; duration six months. Recently had had attacks of nausea and vomiting, alternating attacks of constipation and diarrhoea, malaise and abdominal distention. Stool poorly



FIG. 2.—Case III. Ninety-two centimetres of resected small intestine with a fibroma measuring 2.5 centimetres in diameter, indicated by arrow.

formed, occult blood. *Physical examination.*—Abdominal distention and visible peristalsis. No X-rays taken. *Pre-operative diagnosis.*—Partial intestinal obstruction due to adhesions (appendicectomy, 1910). *Operation.*—Resection. Side-to-side anastomosis. *Diagnosis.*—Adenoma of ileum (intussusception). *Recall.*—Seven months after operation. In excellent health. Bowels regular; gain in weight. *Pathological report.*—The specimen (Fig. 1) of an intussuscepted portion of ileum measuring 20 by 5 by 5 centimetres; its upper half presents a normal serous coat while the distal portion is gangrenous in appearance. When opened the mucosa shows corresponding changes in its gross



## TUMORS OF SMALL INTESTINE

appearance. At the apex of the discolored, intussuscepted bowel is a small tumor measuring 2.5 by 3 by 2 centimetres, definitely encapsulated, firm in consistency and arising from the mucosa by a definite pedicle, so that the tumor mass swings freely within the lumen. *Microscopic diagnosis*.—Adenoma of ileum. Gangrene of small intestine due to intussusception.

CASE III.—(R. H. No. A 2003, Path. No. S.B. 7336.) Date of operation, September 8, 1911. No history attached to chart. Patient obviously operated upon shortly after admission to the hospital. (Probably with signs and symptoms of intestinal obstruction.) *Operation*.—Resection. End-to-end suture with Murphy button. *Diagnosis*.—Fibroma of ileum (intussusception). *Discharged*.—Cured. No follow-up report. *Pathological report*.—Specimen (Fig. 2) consists of 92 centimetres of resected small intestine, 55 centimetres of which is bluish black and looks gangrenous. An area of intussusception which measures 16 centimetres has been opened. Occupying the intestinal lumen at the extreme resected end, there is an encapsulated, pedunculated gland which feels firm and elastic (almost like a small, hard rubber ball), which measures  $2\frac{1}{2}$  centimetres in diameter and is covered by a black, warty looking membrane which peels off easily and exposes a whitish mass of tissue containing blood-vessels on the surface. (On account of the fibroma being a rare tumor it was thought advisable to include a detailed microscopic examination.) *Microscopic examination*.—Tumor is composed of white fibrous tissue containing many blood-vessels and capillaries. Covering one surface of the section there is a very vascular layer of tissue, which is infiltrated with leucocytes, and lies on a fibrous basement membrane. *Microscopic diagnosis*.—Simple fibroma.

CASE IV.—(R. H. No. B 8564, Path. No. S.A. 1646.) Date of operation, November 29, 1916. A man, aged thirty-one years, complaining of hypogastric pain, alternating attacks of constipation and diarrhoea, nausea and vomiting, abdominal distention, malaise and + + + loss of weight. Duration three and one-half months. *Physical examination*.—Revealed visible peristalsis, abdominal distention, palpable mass, ascites, succussion splash, secondary anaemia. X-ray report lost. *Pre-operative diagnosis*.—Neoplasm of colon below splenic flexure. *Operation*.—Resection; side-to-side anastomosis. *Diagnosis*.—Chronic ulcerative infective granuloma. *Result*.—Died one month later, at home, of lobar pneumonia. *Pathological report*.—Specimen (Fig. 3) consists of a portion of small intestine measuring 23 centimetres in length and having an average diameter of 5 centimetres. This has been evaginated so that the lumen is exposed throughout. The mucosa is of a reddish-brown hue and has lost practically all of its normal corrugations. The special pathological features are several elongated hyperplastic ulcerated areas arranged in pell-mell manner and running the direction of the circumference. The lower 4 centimetres of the specimen is entirely involved in the process similar to these ulcerations which appear as a large fungoid bulb-like expansion. *Microscopic diagnosis*.—Chronic ulcerative infective granuloma.

CASE V.—(Leroy H. No. 2201, Path. No. [R. H.] S.C. 5140.) Date of operation, May 11, 1931. A man, aged forty-three years, complaint: collapse, severe intestinal hæmorrhages, malaise of two months' duration. Two years previously had had vague abdominal discomfort, treated for colitis. A chief complaint was that for two years bowel movements had been irregular, not free and of relatively small calibre. No pain in abdomen, no tenderness on palpation. Large amount of blood in stools. Seventeen blood counts taken before operation—average red blood cells 3,275,000; average hæmoglobin 66.7 per cent. Four blood transfusions before operation. Four complete gastro-intestinal X-ray series taken—all negative. *Pre-operative diagnosis*.—Bleeding diverticulum of duodenum. *Operation*.—Resection. Side-to-side anastomosis. *Diagnosis*.—Leiomyoma of jejunum. (Approximately 10 inches from duodeno-jejunal junction.) *Follow-up note*.—March 1, 1932, excellent health. Completely cured. *Pathological report*.—Section of intestine is 7 centimetres in length; 3 centimetres in diameter; contains at its centre within the wall a firm but not stony hard tumor  $2\frac{1}{2}$  centimetres in diameter



FIG. 3.—Case IV. Portion of the terminal ileum measuring 25 centimetres in length with an average diameter of 5 centimetres, evaginated so that the lumen is exposed throughout. Hyperplastic ulcerated areas are running in the direction of the circumference, the lower 4 centimetres of the specimen have a hyperplastic ulcerated area which appears as a large fungoid, bulbous expansion.

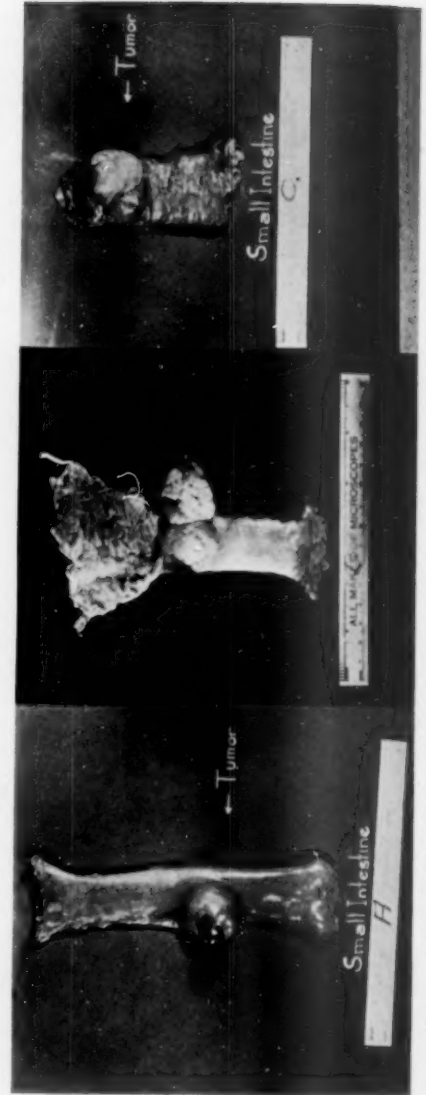


FIG. 4.—Case V. A Myoma protruding from serosal surface of the jejunum. B Cross-section of tumor mass. C Myoma protruding from serosal surface of jejunum.

## TUMORS OF SMALL INTESTINE

which projects from the side of the intestine. (Fig. 4.) It is roughly circular but it has at its tip two small globular projections, each about 1 centimetre in diameter, one of which is very hæmorrhagic in appearance. In general, however, the tumor is grayish-white in color. Upon inverting the intestine the tumor is found to be practically submucosal; the mucosa overlying it presents a tiny split, probably of recent origin. *Microscopic diagnosis*.—Leiomyoma of small intestine. (Benign.)

CASE VI.—(R. H. No. 24699, Path. No. S.B. 9139.) Date of operation, October 17, 1929. A woman of forty-four years of age, complaining of oppression and uneasiness in right upper quadrant of abdomen. Pain at times radiating towards the left. Eating of meat increases symptoms. Other than a life-long constipation, no other history. Slight tenderness on palpation in epigastrium. *X-rays*.—Negative. *Pre-operative diagnosis*.—Chronic cholecystitis. *Operation*.—Excision of aberrant pancreatic tissue tumor from anterior wall of duodenum. *Diagnosis*.—Aberrant pancreatic tissue tumor of duodenum. *Follow-up note*.—Five-year complete cure of symptoms. *Pathological report*.—The portion of the duodenal wall is 1 centimetre in diameter and  $\frac{3}{4}$  centimetre in thickness. The mucosa is smooth. The serosa appears somewhat roughened. *Microscopic diagnosis*.—Aberrant pancreatic tissue in duodenum. Diagnosis confirmed by Doctor Ewing.

CASE VII.—(R. H. No. A 3296, Path. No. not given.) Date of operation, November 26, 1912. A man, aged forty-two years, complaint three months' duration; colicky pains in upper abdomen, beginning on left side and passing over to right side. Onset one hour after meals; gurgling sounds heard and a mass forms in left upper quadrant. Constipation, no diarrhoea. Vomited blood. Distention upper abdomen; + + + + loss of weight. Marked secondary anaemia. Anterior gastroenterostomy with Murphy button. *Diagnosis*.—Carcinoma of jejunum. *Result*.—Discharged from hospital. Improved. (Probably died.)

CASE VIII.—(R. H. No. B 5527, Path. No. B 9374.) Date of operation, July 6, 1914. A male (age not given) complaining of upper abdominal pain with indigestion for six months and loss of weight, jaundiced, tenderness in upper abdomen. *First operation*.—February 11, 1914. Appendicectomy. Division of Lane kink. *Second operation*.—July 6, 1914. Cholecystenterostomy. *Third operation*.—October 20, 1914. Posterior gastroenterostomy. *Diagnosis*.—Carcinoma of the duodenum. *Result*.—Died, January 23, 1915. Inanition. Anaemia. Liver metastasis. *Autopsy report*.—The pylorus is seen to be patent. About  $3\frac{1}{2}$  inches from pylorus there is a very firm annular constriction of the duodenum which has an opening about the bore of a lead pencil. On section this cuts with resistance, and has a fibrous, almost cartilaginous consistency. This lesion is rather sharply demarcated and the mucosa on either side is hyperplastic and congested. The papilla of Vater is about 1 centimetre beyond the constriction. *Microscopic diagnosis*.—Primary adenocarcinoma of duodenum with metastasis to liver. Chronic diffuse pancreatitis. Moderate chronic diffuse nephritis. Chronic inflammation of primary growth in duodenum.

CASE IX.—(R. H. No. B 14107, Path. No. 8760.) Date of operation, April 9, 1921. A woman (age not given); complaint four months' duration, abdominal pain and increasing constipation. Abdominal distention; malaise; —loss of weight. *X-ray report*.—Negative for growth but stasis in the small intestine. *Pre-operative diagnosis*.—Intestinal neoplasm. (Large or small bowel not stated.) *Operation*.—Resection. End-to-end suture. *Diagnosis*.—Carcinoma of ileum. *Result*.—Died, seven hours after operation, of shock. *Pathological report*.—The new growth (Fig. 5) is oval in shape and in size 5 by 6.5 centimetres with a deep ulcerating area 1 by 2.5 centimetres which was perforated at operation. The main portion of the growth is at the site of attachment of the mesentery and almost obliterates the lumen. Atypical acini and epithelial cells growing at will and infiltrating the duct wall. The cells are in various bizarre arrangements, many retaining the acini formation and many breaking through the limiting basement membrane to invade lawlessly in groups or strands the tissue surrounding. The cells vary in

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staining quality and some of their nuclei show mitotic figures. *Diagnosis*.—Adenocarcinoma of ileum.

CASE X.—(R. H. No. 21664, Path. No. 5658.) Date of operation, November 16, 1925. A woman, aged fifty-seven years; complaint epigastric pain, attacks of nausea and vomiting, alternating constipation and diarrhoea and distention; duration six months. Considerable malaise, — — — loss of weight, palpable mass, ascites, secondary anemia, gastric analysis normal. *X-ray*.—Large rounded mass right lower quadrant of abdomen. *Pre-operative diagnosis*.—Carcinoma of stomach. *Operation*.—Ileo-colostomy. Specimen of tissue removed from surface of neoplasm. *Diagnosis*.—Carcinoma (multiple) in last four feet of ileum. *Pathological report*.—Specimen consists of two irregular-shaped pieces of tissue measuring 2 by 4 by 1 centimetre and 2 by 3 by 5 centimetres in their greatest diameter. They are firm in consistency and their cut surfaces present a hard, grayish-white appearance. *Result*.—Died three days post-operative, of peritonitis. *Micro-*

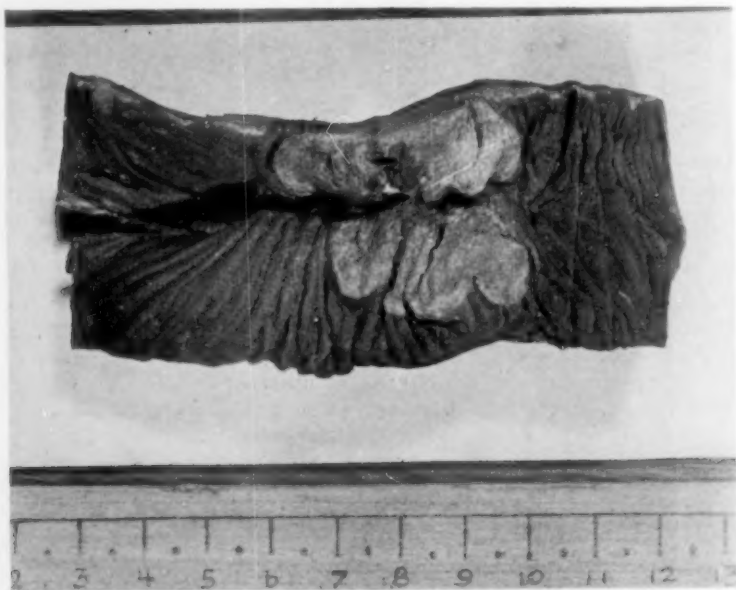


FIG. 5.—Case IX. Carcinoma of the ileum, the neoplasm oval in shape, measuring 5 by 6.5 centimetres, with a deep ulcerating area in the centre measuring 1 by 2.5 centimetres.

*scopic diagnosis*.—Metastatic adenocarcinoma of omentum, probably of intestinal origin.

CASE XI.—(R. H. No. B 29456.) (Autopsy series 1931, No. 16.) Date of autopsy, February 16, 1931. A woman, aged seventy-one years; complaint; duration one week of abdominal pain and distress, nausea and vomiting, malaise for some months. Questioning members of her family revealed that for the past eight or nine years patient had been troubled with severe attacks of "indigestion." Huge doses of soda bicarbonate usually brought relief. *No X-ray report*. *Diagnosis*.—Intestinal obstruction. Cause unknown. *Result*.—Died sixteen hours after admission. *Autopsy report*.—On the inferior aspect of the first part of the duodenum (Fig. 6) there is seen a perforation of triangular form about 1 centimetre in length with red, pouting margin. The pyloric ring is found sharply defined and the mucous membrane on the gastric side is everywhere intact. On the duodenal side the perforation with engorged edges is found 4 centimetres below the pylorus. The mucosa is somewhat gray and papillary, but most of the thickening of the wall is in the deeper layers. Attached to the neighboring serosa are several lymph nodes, the largest 3 centimetres in diameter. *Microscopic diagnosis*.—Adenocarcinoma of duodenum with necrosis and perforation. Metastasis to regional lymph nodes.

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CASE XII.—(R. H. No. B 26912, Path. No. 4830.) Date of operation, November 14, 1931. A woman, aged thirty-nine years, complaint: duration three weeks. Abdominal pain and distress, nausea and vomiting. Alternating attacks of constipation, diarrhoea. Malaise; abdominal distention; + + + loss of weight. Visible peristalsis and tenderness over the abdomen, — blood in stools; the faecal movements themselves were poorly formed. Ascites. *X-rays*.—Showed distended loops of small bowel. Point of obstruction not identified. Appendix removed seven years ago. Members of family maintain that for past two years patient has had attacks of pain about every six weeks, generally in the right lower quadrant of abdomen accompanied by nausea and vomiting. For three weeks previous to operation the patient had been treated by family physician for tuberculous peritonitis. *Pre-operative diagnosis*.—Partial intestinal obstruction, due to adhesions in the terminal ileum. *Operation*.—Resection terminal ileum and ascending colon. Side-to-side anastomosis. Enterostomy (Witzel-Mayo) 10 inches above site of

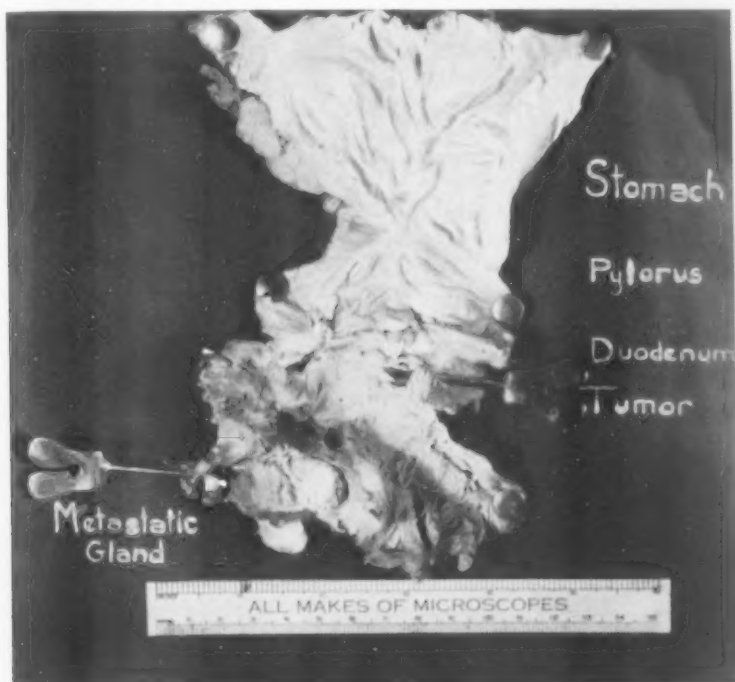


FIG. 6.—Case XI. Carcinoma of the duodenum indicated by the upper grooved director. The lower grooved director points to a large metastatic lymph-node measuring 3 centimetres in diameter.

anastomosis. *Result*.—Died eighth day post-operative, of peritonitis. (On account of even partial obstruction a two-stage procedure would have been a wiser plan.) *Pathological report*.—Specimen consists of the caecum, measuring about 16 centimetres, and the terminal ileum, measuring 8 centimetres. On the serous surface the centre of the ileum shows a definite constriction pinching in the bowel wall at a distance 4.5 centimetres from the ileo-caecal junction. On opening the bowel there is found in the ileum a soft, papillary, sessile mass which encircles the lumen; has rolled edges and a central ulceration. The total length is 4 centimetres; average thickness is 1.2 centimetres. On section the entire thickness of the intestinal wall is involved. Beyond the tumor the ileum is distinguishable and has a normal mucosa for its terminal 3 centimetres. A lymph node removed from the mesentery consists of a fatty mass 3.5 by 1.5 by 2 centimetres. On section grayish-white hard nodules are seen within this. *Microscopic diag-*



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*nosis*.—Adenocarcinoma of ileum, Grade III, with metastases to lymph node of mesentery.

CASE XIII.—(R. H. No. B 25225, Path. No. S.B. 9869.) Date of operation, February 23, 1928. A male, aged fifty-four years, complaining of severe abdominal pain, cramp-like in region of umbilicus, relieved frequently by bowel movements. Intense desire to defecate frequently. Duration of symptoms one month; — loss of weight. *X-rays*.—Irregular filling of the small bowel, dilatation and gas, distention of loops of ileum. *Pre-operative diagnosis*.—Carcinoma of colon. *Operation*.—Exploratory celiotomy. Removal of lymph node for diagnosis. There were two areas in the small intestine, about 8 inches apart on the anti-mesenteric surface, the distal one the size of a silver quarter, about 1½ inches thick, with a nipple-like projection on the serosal side. On cæcum a pedunculated mass the size of a man's fist. Enlarged mesenteric lymph nodes. *Diagnosis*.—Undetermined at operation. *Pathological report*.—Specimen consists of a lymph node 1 centimetre in diameter. Capsule is intact. On section what seems to be a layer of normal lymphoid tissue ¼ centimetre in thickness surrounds a white, homogeneous friable centre. Dense fibrous capsule within which is a dense cellular mass largely composed of reticulo-endothelial cells among which are scattered lymphocytes. Cells poorly stained, frequently contain pale vesicular nuclei. Many giant cells are present with single or multiple pale nuclei. Cytoplasm granular and stains poorly. Mitosis is a rather common occurrence. No eosinophiles seen. *Microscopic diagnosis*.—Intestinal Hodgkin's disease.

CASE XIV.—(R. H. No. A 780, Path. No. 3482.) Date of operation, August 13, 1910. A man (age not given), complaint, duration three weeks. Abdominal pain accompanied by "marked gurgling noises," no nausea or vomiting, ++ loss of weight. *Operation*.—Resection. Side-to-side anastomosis. *Diagnosis*.—Sarcoma of terminal ileum (intussusception). *Result*.—Discharged improved. No recall. *Pathological report*.—Erosion of mucous membrane with superficial necrosis and inflammation. Depths of tumor made of small round cells extending to muscular layer and invading it to a certain extent. *Microscopic diagnosis*.—Round-cell lymphosarcoma, neighboring glands show involvement.

CASE XV.—(R. H. No. A 26965, Path. No. S.B. 8601.) Date of operation, June 18, 1927. A boy, four years of age, complaining of acute pain in abdomen, malaise, attacks of nausea and vomiting and + loss of weight. Duration four months. Parents state prior to present illness, patient had begun to "lose in general health" with appetite poor and color pale. *Pre-operative diagnosis*.—Intussusception. *Operation*.—Resection. End-to-End suture. *Diagnosis*.—Sarcoma of ileum. *Result*.—Died nine hours following operation, from shock. *Pathological report*.—Specimen consists of 30 to 40 centimetres of small intestine near the centre of which there is an oval mass measuring 5 by 7 centimetres. The tumor mass was formed by thickening of the gut wall. Several yellow, necrotic areas on surface of the tumor. On section of the tumor, mass found to be largely necrotic. Lumen is dilated; lined with necrotic mucosa; and filled with bloody faecal matter. Total weight of whole mass is 275 grams. *Microscopic diagnosis*.—Lymphosarcoma of ileum.

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## LATE RESULTS IN THE OPERATIVE TREATMENT OF CARCINOMA OF THE BREAST\*

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THE results of our efforts, in behalf of the patient suffering from cancer, whether this be by surgery, radiotherapy, or a combination of both, should be surveyed from time to time, either to check the undue optimism which an occasional brilliant result will engender, or, on the other hand, to stifle the pessimism which has lately gripped the profession, as the result of a more complete follow-up of our patients. It is well known that clinical judgments based upon supposition are prone to be fallacious, and it is only by the systematic study of a group of cases, followed over a sufficiently long period of time, that we can arrive at a true estimate of the efficacy of our treatment.

Cancer of the breast lends itself particularly to this analysis. The lesion is usually superficially situated, the diagnosis readily established clinically or by operation and microscopical examination of the removed tissue, and the results of our therapy readily ascertainable by superficial palpation of the operative field, or by X-ray diagnosis of chest and bones where metastases most frequently manifest themselves. (Cartnett,<sup>1</sup> Lenz<sup>2</sup>.)

Since the work of Halsted and Willy Meyer, the operation, with minor modifications only of incision and skin excision (Jennings<sup>3</sup>), has become standardized, so that changes in technic cannot be held to account for differences in the end-results in any of the yearly groups to be reviewed. In this series, the Halsted incision, with removal of both pectoral muscles, was used exclusively, although, at present, a number of surgeons are using the transverse or Stewart incision.

The advent of X-ray and radium therapy, in combination with surgery, has necessitated taking these added therapeutic factors into account in an analysis of results. Numerous other factors must enter here, *viz.*, the duration of the disease, its extent, the age of the patient, the biological characteristics of the neoplasm. It is almost impossible to evaluate all these factors in any given patient, nor have I attempted to do so in all these particulars, although a few of the above considerations will be discussed under prognosis, as determined by the follow-up. I have merely attempted, in so far as possible, to present a cross-section of the breast-cancer material admitted to a general hospital with particular reference to the results obtained with our therapeutic efforts.

For this purpose, I have taken the cases of breast cancer admitted to the general surgical service of the Mount Sinai Hospital from the years

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\* Read before the New York Surgical Society, February 24, 1932.

## CARCINOMA OF BREAST

1922 inclusive of 1926, reviewing only those cases considered as operative and in which a radical mastectomy was done, without regard to the extent of the disease, its duration or other factors which will be seen to influence prognosis. It will be noted that the period of elapsed time since operation in the most recent cases will have been at least five years.

The author, in collaboration with Drs. A. V. Moschcowitz and R. Colp,<sup>4</sup> undertook a similar study in 1926, and the results obtained in this series will be compared with this later group in an attempt to establish whether the results of our therapeutic efforts have improved.

This report comprises a study of fifty-seven cases of breast cancer, all of which were operated upon radically. There were fifty-nine operations, two of the patients returning subsequently with carcinomata in the remaining breast which necessitated mastectomy. No case is included in which the diagnosis was not confirmed by pathological examination of the tumor. Of these fifty-seven patients, two died as the direct result of operation—the first of these from infection, the second from a cerebral accident ten days post-operatively.

*Sex.*—There was one male patient in this series. His history dated back twelve years prior to admission seeking surgical relief only for a small ulcerating carcinoma near the nipple without lymph-node involvement. He died of distant metastases three years after operation. It would seem as if operation had disseminated a relatively benign form of growth.

*Age.*—Of the fifty-seven cases, one was below the age of twenty; two were in the second decade; eleven between thirty-one and forty; twenty-three between forty-one and fifty; thirteen between fifty-one and sixty; and seven between sixty-one and seventy-one. The influence of age upon prognosis will be discussed under follow-up.

*Follow-up.*—Of the fifty-seven patients admitted during the years 1922 and inclusive of 1926, two died in the hospital, following operation, leaving fifty-five patients whom it was possible to follow. Of this number, we obtained follow-up results of sufficient length of time to be of value in forty-two, or almost 75 per cent. of the cases; in two instances patients were lost track of by moving to different communities, in one after a follow-up of four years. Patients lost to follow-up are classified as dead of cancer and are tabulated as having died in the first year.

Of the thirteen patients operated upon in 1922 we have been able to follow and ascertain the end-results in eight. In four of these patients we have no follow-up data of any kind. One was lost track of in 1924, receiving X-ray therapy at St. Luke's Hospital, where there was no evidence of recurrence at that time, but the follow-up period is too short to be of value. Six of these patients have died; five of carcinoma, one of an intercurrent hemiplegia about six months ago, who, after her most recent follow-up, showed no evidence of any recurrence. One patient is alive and well; she has received no form of therapy since operation. One patient is living but is under treatment at Montefiore Hospital for metastases of her lung, skull and femur.

The average duration of life of the five patients who died with known carcinoma was three years.

*Summary.*—Of thirteen patients operated upon ten years ago, two are living, one of these with advanced recurrent disease. One patient died of an intercurrent disease apparently free of carcinoma nine years after operation. Over a ten-year period, including this last patient, 15 per cent. of the patients can be estimated to have been relieved of their disease.

Of the patients operated upon in 1923, totaling seven, four have died of carcinoma, the other three cases have been lost sight of. The average duration of life of those who were followed was slightly less than two years.

Of the nine patients operated upon in 1924, two are alive and well; one patient was not followed; of the six patients who died, one of these died in the hospital. Of the other five, one died six years after operation. The average duration of life after operation of those succumbing to the disease was three years.

In 1925, eleven patients were operated upon. All these patients were followed. Seven of these have died. Four patients are alive and well.

In 1926, eighteen patients were operated upon. Three patients were lost to follow-up. One patient was followed for three years and then moved to Canada. Up to that time she was free of recurrence. Five of this group are now living and well when last seen, no case being heard from or observed more than three months prior to this writing. Nine of these patients have died.

Summarizing the results of this follow-up (Table I) we find that twelve of a total of fifty-seven operated cases are alive and well for at least a period of five years. One patient who is not included in this number died of an intercurrent disease a few months ago, who had lived ten years, free of recurrence, before her death. If she were included, thirteen, or about 23 per cent., of the patients in this series would be alive and well for at least a period of five years. Of this number one would be living ten years, two for a period of eight years, four for a period of seven years, and five for a period of six or five years, depending upon how late in the year 1926 they were operated upon.

A number of patients in this series have lived more than five years, eventually succumbing to their disease, or are now alive but suffering from recurrences. These patients are classified as dead of cancer. Of the patients operated upon ten years ago, one is still alive and one lived for a period of six years after operation; three patients have lived for a four-year period; the others succumbed at varying intervals, the average being about two and a half years.

Lymph-nodes were involved with cancer in 72 per cent. of this group. Of the patients who are now living and well, about one-half were free of lymph-node involvement at the time of operation. Of the total number of patients free of lymph-node involvement, 40 per cent. have survived the five-year period; on the other hand, of those patients presenting themselves with



# CARCINOMA OF BREAST

TABLE I

Year	No. of Pts.	1 yr. Died	2 yrs. Living	3 yrs. D. L.	4 yrs. D. L.	5 yrs. D. L.	6 yrs. D. L.	7 yrs. D. L.	8 yrs. D. L.	9 yrs. D. L.	10 yrs. D. L.										
1922.....	13	4	9	5	8	6	7	9	4	9	4	10	3	10	3	10	3	12	1	12	1*
1923.....	7	4	3	5	2	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0
1924.....	8	2	6	5	3	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2
1925.....	11	3	8	5	6	6	5	7	4	7	4	7	4	7	4	7	4	7	4	7	4
1926.....	18	5	13	6	12	10	8	12	6	13	5	13	5								
No. of Cases Operated on.....	57	18	39	26	31	35	22	41	16	42	15	43	14	9	5	1	1				

\* One patient living with recurrence; one patient dead of intercurrent disease without recurrence.

lymph-node involvement, only about 17 per cent. have survived at least this five-year period. This marked difference in longevity in the group without lymph-node involvement bespeaks again the importance of early diagnosis and therapy before the carcinoma has invaded the lymphatic tributaries.

Of the patients dead of carcinoma and in whom the cause of death has been ascertained, approximately 90 per cent. have died of distant metastases. Mediastinal and chest metastases were the most frequent site of involvement. The osseous system was next in order of frequency, to be followed by liver and abdominal metastases in about 15 per cent. of the cases. Skin and supraclavicular node recurrence was present in approximately 25 per cent. of those succumbing to their disease.

Only two patients of this group who have survived were under forty years of age. Three patients, one in the second decade and two in the third decade, the former without lymph-node involvement, have all succumbed. The virulence of breast cancer in the young has recently been stressed by Burton J. Lee,<sup>5</sup> and in the few opportunities we have had to observe this group, our results have also been discouraging.

Of four patients who had preliminary biopsy, followed by radical operation at an interval of a few days, three are alive and well. The recurrence in this small group was a young woman, nineteen years of age, in whom the age factor is so striking as to account for prompt recrudescence. The two patients who returned subsequently with carcinoma in the remaining breast died of their disease.

We have not given pre-operative X-ray therapy to any patient in this group. Practically all have received some form of post-operative treatment.

It is extremely difficult to estimate the factor of X-ray or radium therapy or their combination as it affects the results of operative treatment. In the primarily reported series of cases, encompassing the years 1915 to 1924 and in which a five-year period of follow-up was possible, 17 per cent. of the patients were alive and well. In this series our results are slightly improved. Whether this difference can be attributed to X-ray therapy is conjectural.

No attempt has been made to analyze the size of the tumor or its duration as it affects prognosis because of the small number of cases in this series. Suffice it to say that no patient with ulceration of the skin, peau d'orange, or redness and infiltration of the surrounding skin has lived for a five-year period.

*Summary.*—A series of breast carcinomata admitted between the years 1922 and inclusive of 1926 are reviewed with particular reference to end-results.

(1) At this writing, a follow-up period of at least five years, 23 per cent. of the patients are alive and well.

(2) At the end of five years' follow-up, fifteen patients of this series are alive and well.

(3) Three patients in this series died of carcinoma after a five-year period of longevity.

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(4) Forty per cent. of the patients without lymph-node involvement have survived a five-year period; whereas only 17 per cent. with lymph-node involvement have lived for this period of time.

CONCLUSIONS.—The results of the treatment of breast cancer as seen on a general surgical service are still far from encouraging based upon a sufficiently long period of follow-up.

The relatively benign course of those patients without lymph-node involvement would indicate that our results will improve with refinement in diagnosis, the extent of the disease, and the age of the patient.

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## PERIMESENTERIC INTRA-ABDOMINAL HERNIA

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HERNIAS through abnormal openings of the mesentery of the small intestine are rare. Hertzler<sup>1</sup> refers to only one case of this type which was reported by Little in 1871. Watson<sup>2</sup> states that in sixteen hundred autopsies an opening in the mesentery was found in three, all of which were located near the ileocaecal junction and in none of which was a hernia present.

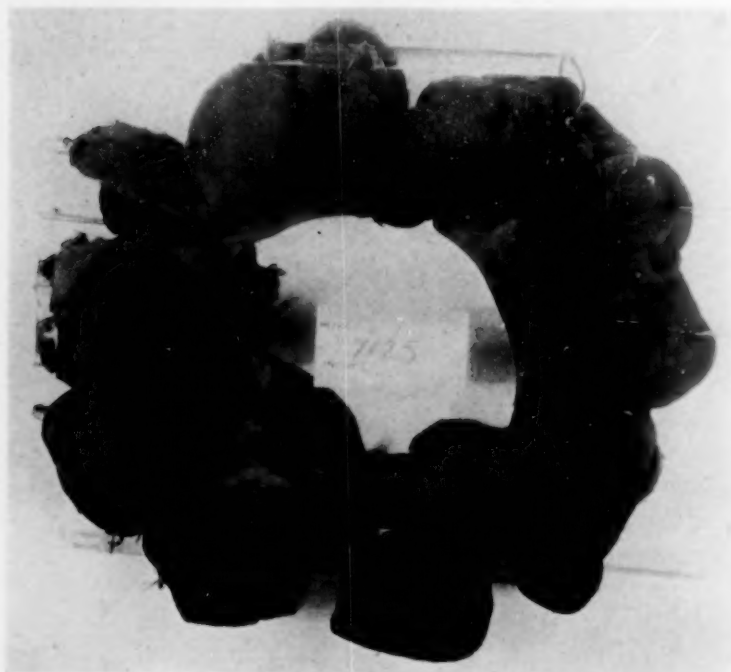


FIG. 1.—Opening in the mesentery through which the sigmoid passed. The darker portion of ileum was carried through the opening with the sigmoid, and was gangrenous.

Moynihan<sup>3</sup> in his monograph on internal hernia merely mentions this type.

Brown<sup>4</sup> in 1920 collected nineteen cases from the literature and reported one, and Cutler<sup>5</sup> in 1925 added to these six from the literature and reported two more of his own. Since then there have been seven cases reported to which I wish to add another. The case reported by Little in 1871 is also included in this report.

CASE I.—The patient, a white girl, twelve years of age, walked into the hospital November 17, 1930, at 5.30 P.M., complaining of pain in the abdomen and vomiting. Two days previously she had experienced sudden severe pain in the epigastrium followed by

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vomiting. Following several doses of castor-oil and enemas, her parents stated that the bowels moved with the enemas, although both they and the patient were positive there was no blood passed and there were no tarry stools. The cathartic caused severe abdominal pain. The only essential point in the past history was occasional pain in abdomen for two weeks previous to the onset of the present illness. There was no history of trauma. The patient's bowels moved regularly prior to her present illness.

The patient was a well-developed but poorly nourished white girl of twelve years, acutely ill. Her temperature was  $38.2^{\circ}\text{C}$ . The abdomen was moderately distended but no peristalsis was seen. There was rigidity and tenderness over the entire abdomen, more marked in the lower portion in the mid-line. Shifting dullness could not be elicited. On auscultation no borborygmus was heard. Rectal examination revealed slight tenderness anteriorly but no palpable mass. The patient became rapidly worse, vomited several times, and expired forty minutes after admission.

*Autopsy* was performed the same day. The peritoneal cavity contained three hundred cubic centimetres of bloody fluid. In the lower abdomen there were several loops of large bowel which were gangrenous. There was an opening (Fig. 1) in the mesentery of the small intestine measuring 8 by 7 centimetres situated about ten centimetres above the ileocaecal junction. The edges were smooth and blood-vessels could be seen in the mesentery at the edge of the opening. The sigmoid had a long mesentery, was twisted on itself once, and had passed through the mesenteric defect twice. It was wrapped around the ileum attached to this region of the mesentery and had carried this portion of the ileum through the opening with it as it passed through the second time. This loop of ileum was gangrenous and distended, as was the twisted portion of the sigmoid. The hernia could not be reduced without enlarging the opening in the mesentery.

The ileum above the strangulation contained dark blood. No gross blood was found below the volvulus. The stomach and small intestine above the strangulation were dilated.

Practically all of the literature on this subject, as Cutler has pointed out, is in the form of case reports. Most text-books either do not mention it or refer to it very briefly. The origin of these mesenteric defects has been the source of considerable speculation. It seems to me that most of these anomalies are congenital and can be easily explained on a purely mechanical basis if one recalls the embryological development of these parts.

One should bear in mind that the weakest point in the mesentery is an area near the ileocaecal junction where there is an area free of fat, lymph-nodes, and blood-vessels, and that it is in this region the openings are nearly always found. During the seventh week of fetal life, as Mall<sup>7</sup> has said, the rapidly enlarging liver occupies so much space in the small abdominal cavity that there is insufficient room for the expansion of the intestinal tube. The greater part of the intestine, in consequence, is displaced from the abdominal cavity into the coelom within the umbilical cord, and when the intestines are pushed out a hole is sometimes made in the mesentery at its weakest point. This is a very plausible explanation of the formation of these defects.

There probably are some, however, which are the result of trauma in later life, *e.g.*, those in which the openings are slit-like and whose edges are ragged. The case reported by Brown<sup>8</sup> is the best example of this and the symptoms in that instance began after a fall. The opening was slit-like with ragged edges and was apparently of recent origin.

Another theory on the congenital origin of these defects is proposed by



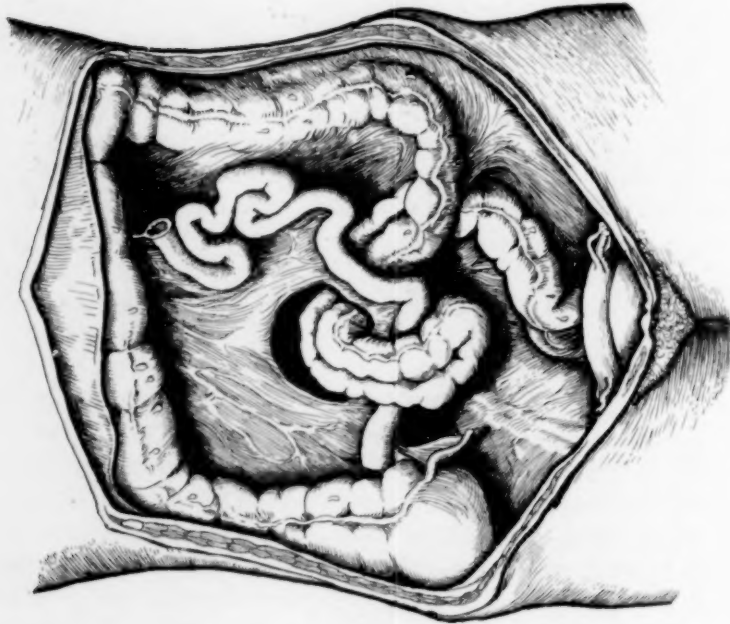


FIG. 2.

FIG. 2.—Diagram showing defect in mesentery situated near the ileocaecal junction. The sigmoid, which is twisted  $180^{\circ}$ , is shown as it entered the defect the first time.

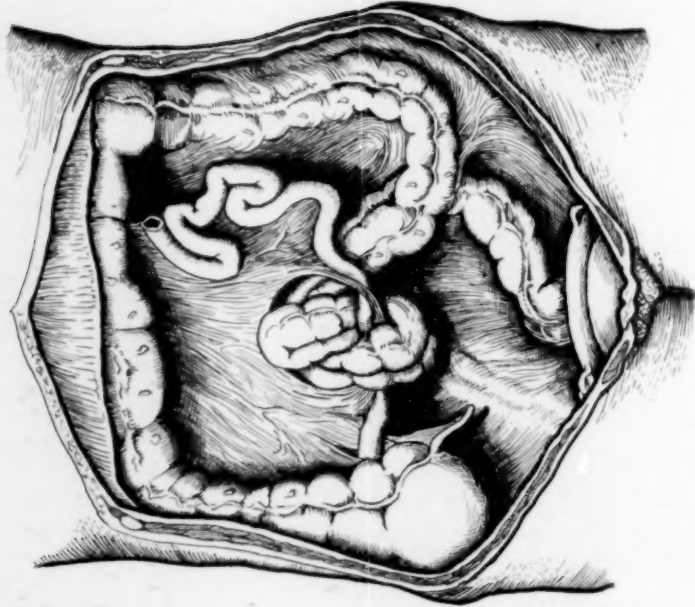


FIG. 3.

FIG. 3.—Diagram showing the sigmoid passing through the defect the second time carrying with it the adjacent ileum.

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Federschmidt. He says that there is a physiological regression of the mesentery which only involves the ventral mesentery in humans but in other mammals it also occurs in the dorsal mesentery. Therefore, he says it is an atavistic characteristic. The objection to this was that it did not explain why the opening only occurred at the lower end of the mesentery. The case reported by Long,<sup>9</sup> however, lends support to this theory as there were several fenestræ scattered along the entire length of the mesentery.

Hommes<sup>8</sup> is of the opinion that there are definite anatomical relationships which cause these defects. He says Treves found that the ileocolic artery



FIG. 4.—Diagram showing rotation and consequent strangulation of ileum. The shaded bowel represents that portion which was gangrenous.

and its anastomosis with the last large artery of the small intestine incloses a field which contains neither fat, lymph-nodes, or blood-vessels, and it was here that the defects were found by him. In the two cases reported by Hommes the opening lay between the strongly developed right colic artery and the artery ileimagna so that a true ileocolic artery was missing.

The superior mesenteric artery supplies the lower ileum, cæcum, appendix, and ascending colon. It develops out of the originally paired and later single omphalomesenteric artery, and travels many segments caudally so that variations are frequent. Hommes convinced himself through many laparotomies that the blood supply of the lower ileum comes for the greatest part from a

large branch of the superior mesenteric artery (artery ileimagna) which has a small anastomosis with the ramus iliacus which is the smallest developed branch of the ileocolic artery. In both of his cases the ileocolic artery was missing and the artery ileimagna was well developed and ran along the medial border of the defect.

Hohlbaum<sup>6</sup> and Prutz believe inflammation is the cause of these defects. As a rule no signs of inflammation can be made out and since mesenteric defects do not occur after peritonitis, it seems highly improbable that inflammation plays a part in their formation.

SUMMARY OF CASES REPORTED OF MESENTERIC DEFECTS AS A CAUSE OF INTESTINAL OBSTRUCTION

CASE I.—Reported by C. G. Franklin. Male, seventy-three years old. History.—Intestinal obstruction five days. Sudden abdominal pain. Vomiting became fecal two days before admission. Operation.—Opening enlarged. Reduction. Findings.—Coil of small intestine 6 inches long tightly strangulated in aperture of mesentery. Pathology.—Bowel deep red, port-wine color and deeply indented by ring. Result.—Recovery.

CASE II.—Reported by J. G. Smith. Male, twelve years old. History.—Three weeks before pain and vomiting. Improved. Three days later had another attack. Operation.—Reduction. Findings.—Bloody fluid in abdomen. Loop of strangulated intestine, very dark color, through hole in mesentery. Pathology.—Very dark-colored strangulated loop bowel through hole in mesentery. Result.—Recovery.

CASE III.—Reported by J. S. Smith. Female, fifteen years old. History.—Sudden abdominal pain and vomiting. Symptoms of intestinal obstruction followed, lasting until operation on fourth day. Operation.—Reduction. Findings.—Greatly congested loop of intestine in hole in mesentery  $2\frac{1}{4}$  by 2 inches. Pathology.—Congested loop of intestine through hole which had smooth thick margin. Congenital in type. Result.—Recovery. Remarks.—No history of trauma.

CASE IV.—Reported by J. Clark. Female, fifteen years old. History.—Sudden abdominal pain and vomiting. Fourteen hours later in state of collapse. Complete intestinal obstruction. No operation. Pathology.—Autopsy—Thirty ounces bloody fluid in abdominal cavity. Four feet lower ileum strangulated through aperture in mesentery. Evidence of old peritonitis in this area. Result.—Death three hours post-operative. Remarks.—Four years previously had been run over by a trap.

CASE V.—Reported by A. P. C. Ashhurst. Male, twelve years old. History.—Patient fell and hurt hip; next day dietetic error. Abdominal pain, vomiting and symptoms of intestinal obstruction for three days. Abdomen distended; fecal vomiting; blood and mucus by bowel. Operation.—Resection 14 to 18 inches intestine. End-to-end anastomosis. Drainage of pelvis. Findings.—Fecal-smelling bloody fluid in abdomen. Black coil of gut in pelvis resembling volvulus. Pathology.—Hole in mesentery. Ileum passed through until stopped by base of Meckel's diverticulum. Result.—Death three hours post-operative. Remarks.—Umbilicus suggested Meckel's diverticulum. Fell and hurt hip day before abdominal attack.

CASE VI.—Reported by J. B. Deaver. Male, twelve years old. History.—Sudden severe pain while cranking car; relieved. Six months later while again cranking car severe pain; did not subside. Moribund on admission. No operation. Pathology.—Autopsy—Strangulated, gangrenous coil of intestine through a congenital hole in mesentery. Result.—Death. Remarks.—Pain while cranking car twice, six months' interval.

CASE VII.—Reported by W. A. Lane. Male, ten years old. History.—Sudden, violent pain came on while asleep, in central part of abdomen. Vomited. Thoroughly purged by family physician. Two days later collapsed and became moribund. Operation.—Second day after onset. Findings.—Mass of bluish intestine  $3\frac{1}{2}$  feet long passed

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through  $\frac{3}{8}$ -inch hole in mesentery. Lower end was 2 feet above ileocaecal juncture. Pathology.—Foul-smelling bloody fluid; gangrenous loop  $3\frac{1}{2}$  feet long through hole in mesentery  $\frac{7}{8}$  inch; rough edges. Result.—Death on operating table. Remarks.—Attack came on while asleep. No history of previous attack or trauma.

CASE VIII.—Reported by L. J. Mitchell. Male, eight years old. History.—Second day after fall downstairs had severe abdominal pain. Diagnosed by outside physician as peritonitis. No operation. Pathology.—Autopsy—Opening in mesentery near ileocaecal juncture. Several loops of strangulated bowel through smooth-margined hole in mesentery. Result.—Death fourth day. Remarks.—Fell downstairs, landing on abdomen; apparently unhurt. Two days later abdominal symptoms.

CASE IX.—Reported by A. B. Atherton. Male, fourteen years old. History.—Pain began with dietetic indiscretion. Patient was well purged with calomel. Seen second day after onset of symptoms of obstruction. Operation.—Removed a twisted Meckel's diverticulum; relieving obstruction. Findings.—Loop of ileum one foot long through hole in mesentery 6 inches from ileocaecal juncture, not gangrenous and easily reduced. Post-mortem examination. Result.—Death third day. Remarks.—Subject to attacks of abdominal cramps since six years old.

CASE X.—Reported by Mauclaire. Female, twenty-one years old. History.—Signs of complete intestinal obstruction for five days. Mass palpated between umbilicus and pubis. Operative findings.—Strangulation of 30 to 40 centimetres of intestine through hole size of palm of hand in mesentery. Pathology.—Margin of hole denoted it had been of long standing. Result.—Death ten hours post-operative. Remarks.—She fell some days before appearance of symptoms.

CASE XI.—Reported by E. C. Stabb. Female, thirty-eight years old. History.—Eleven days before admission had severe abdominal pain which lasted five days, then ceased. Complete obstruction since first attack of pain. In state of collapse. Operation.—Reduction. Findings.—Large intestine collapsed from caecum to sigmoid. On exposing small bowel, a portion slipped out of a circular hole in mesentery  $\frac{5}{8}$  inch in diameter, 3 inches from ileocaecal juncture. Blood supply good. Pathology.—Autopsy—Nothing further found. Result.—Death eight hours post-operative. Remarks.—Always suffered with constipation. No history of abdominal injury.

CASE XII.—Reported by F. W. Speidel. Male, adult. History.—Patient had severe abdominal cramps which became more severe on way home. No wound of abdomen. Pain one inch below and to the right of umbilicus. Vomiting bile. Given morphia freely; in 3 hours relieved.— $10\frac{1}{2}$  gr. s c. In short time given dose of opium and in fifteen minutes he was quiet. Urine oz. 2 obtained by catheter. No vomiting. Calomel oil Y enemas brought no results. Eleven days after onset operation. Operation.—Eleventh day. Reduction. Result.—Death seventh day post-operative. Eighteenth day after onset. No bowel movement. Remarks.—Man shot by companion while hunting. Part of charge entering thigh and arm. While on way to sudden attack of cramps, had a bowel movement. At instant shot was fired threw up his hand and pitched forward on the ground.

CASE XIII.—Reported by N. Macphatter. Female, seventy-three years old. History.—Patient complained of not feeling well and inability to move bowels. On the fourth day showed symptoms of intestinal obstruction. Operation.—Hole enlarged. Reduction. Hole closed. Findings.—Loop of bowel through mesentery, twisted, not gangrenous. Result.—Recovery. Remarks.—No history of trauma.

CASE XIV.—Reported by G. K. Dickenson. Male, forty-five years old. History.—Symptoms of acute intestinal obstruction. Operative findings.—General peritonitis. Hole in mesentery in region of caecum. Smooth margins 2 inches in diameter. A 2-inch coil of intestine through the hole. Result.—Not stated. Remarks.—Author does not mention duration of condition, condition of bowel, what was done, whether there was history of trauma or result.

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CASE XV.—Reported by W. D. Hamaker. Female, seventy-two years old. History.—Obstinate constipation for many years. Sudden onset of symptoms of intestinal obstruction. Operation third day after onset of acute symptoms. Operation.—Removed Meckel's diverticulum and gangrenous omentum. Reduced hernia. Findings.—Meckel's diverticulum rolled up in one edge of gangrenous omentum. Rent in upper part of mesentery, through which passed all transverse colon and omentum. Opening size egg. Condition evidently of long standing.

CASE XVI.—Reported by C. H. Frazier. Male, thirty years old. History.—Symptoms of acute intestinal obstruction. Operation third day after onset. Operation.—Reduction. Findings.—Eighteen inches of congested small intestine protruding through a slit in the mesentery, easily reduced. Pathology.—Slit probably of long standing. Result.—Recovery. Remarks.—Attack similar to present illness thirteen years ago. No history of trauma or dietetic indiscretion.

CASE XVII.—Reported by J. B. Roberts. Male, nineteen years old. History.—Pain and other symptoms of intestinal obstruction. No stool for five days. Abdomen distention. Operation.—Reduction. Findings.—In ileocaecal region, small intestine entangled in an opening in mesentery. Easily reduced. No gangrene. Orifices seemed congenital. Pathology.—There was apparently no actual protrusion of a loop through mesenteric opening but the bent intestine was thrust into opening so that sharp bend closed lumen. Result.—Recovery. Remarks.—Somewhat similar attack one year previously.

CASE XVIII.—Reported by Giovanoff. Result.—Recovery. Remarks.—Incarcerated intestine in aperture of vitello-intestinal duct.

CASE XIX.—Reported by Herczel. Result.—Recovery. Remarks.—Intestine incarcerated with doubled volvulus in mesentery opening.

CASE XX.—Reported by H. P. Brown, Jr.<sup>4</sup> Male, five years old. History.—Admitted two days after fall. Pain in abdomen and vomited; continued next day. No stool. Rigid, distended abdomen. No mass. Temperature 101°; pulse 140; respiration 46; white blood cells 21,000. Operation fourth day. Resection end-to-end anastomosis with Murphy button; whole closed in layers. Findings.—One-half litre blood-tinged fluid. Knuckle gangrenous; gut 20 to 30 centimetres presented a coil of lower ileum which had passed through a 3-centimetre opening in mesentery and twisted on itself two and one-half times. Opening 5 centimetres below caecum had rough edges apparently of recent origin.

CASE XXI.—Reported by Pye-Smith. Male, thirteen years old. History.—Acute intestinal obstruction for four days. Operation.—Constriction relieved. Findings.—Constricting band was Meckel's diverticulum attached to mesentery, passing through hole in mesentery encircling bowel. Result.—Recovery. Remarks.—Bowels moved spontaneously twelve hours after constriction; relieved and piece of fish tin  $3\frac{1}{4}$  by  $\frac{3}{4}$  inch was passed.

CASE XXII.—Reported by W. E. Darnall. Female, forty years old. History.—One month after hysterectomy had pain, vomiting, and obstruction. Operation second day. Operation.—Twelve inches ileum. Resection and anastomosis with Murphy button; drain. Findings.—Through an opening in mesentery of second loop of ileum there had slipped a loop of first loop on left under spleen. Volvulus of loop gangrenous and perforation. Result.—Death five hours post-operative. Remarks.—Pelvis normal.

CASE XXIII.—Reported by Sohn. Remarks.—Adds another case to 52 on record with gap in mesentery of small intestine.

CASE XXIV.—Reported by G. D. Cutler.<sup>5</sup> Female, nine years and three months old. History.—Severe abdominal pain and vomiting eighteen hours' duration. Temperature 100.8°; pulse 144; respiration 24; white blood cells 38,000, polynuclears 94 per cent., monocytes 6 per cent. Operation.—Resection of ileum and Meckel's diverticulum. Lateral anastomosis. Findings.—Loop of gangrenous ileum through hole in mesentery. Pathology.—Blood-stained free fluid; gangrenous loop of bowel 18 inches with Meckel's diver-



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ticulum. Result.—Recovery. Remarks.—No history of trauma. Previous attack six weeks before.—Appendicitis with peritonitis.

CASE XXV.—Male, six years old. History.—Pain in abdomen and vomiting twenty-four hours' duration. Temperature 103.5°; pulse 180; respiration 48. Tenderness and rigidity. Condition grave. Operation.—Resection. End-to-end anastomosis. Findings.—Bowel gangrenous; loop through small hole in mesentery. Impossible to manipulate it. Resection and anastomosis. Pathology.—Foul serous fluid; black loop bowel through hole in mesentery. Result.—Death on table. Remarks.—No history of trauma or previous attacks. Appendicitis with peritonitis?

CASES XXVI, XXVII, and XXVIII.—Reported by Hohlbaum. History.—In one case history tuberculous mesenteric adenitis. In two cases severe strangulation with alarming symptoms and rapidly spreading gangrene. Findings.—In one case anomaly of sigmoid present. In another case volvulus of loop.

CASE XXIX.—Reported by E. R. Long.<sup>9</sup> Male, four days old. History.—No bowel movements, distention and vomiting. Operation.—Fourth day. Patient moribund, so nothing was done. Findings.—Bloody fluid in peritoneal cavity. Large loop of bowel without mesentery. Pathology.—Multiple fenestration of mesentery. Lower ileum passed through one of these openings and was twisted. Result.—Died. Remarks.—Only case with multiple holes. Herniation took place during intra-uterine life.

CASE XXX.—Report by Cabot.<sup>12</sup> Male, thirty years old. History.—Pain and vomiting. Operation.—Three feet of small intestine resected. Two-stage operation. Findings.—Three feet of greatly distended gut through opening near cæcum. Pathology.—Gangrenous bowel. Result.—Recovery.

CASE XXXI.—Reported by J. White.<sup>10</sup> Male, eight and one-half years old. History.—Sharp stabbing pains in lower abdomen and "sickness." Abdominal pain four years previous. Operation.—Reduced hernia and volvulus. Findings.—Lower part of ileum, cæcum, appendix, and lower part of ascending colon slipped through 2-inch hole in mesentery and twice twisted on itself. Pathology.—Hole had smooth, thickened edges, and around it were some enlarged glands. Result.—Recovery.

CASE XXXII.—Reported by P. Muller.<sup>11</sup> Male, thirty-nine years old. History.—Sudden violent abdominal pain and vomiting. Constipation and vague abdominal pain for fifteen years. Similar attack twelve years previously. Operation.—None. Patient moribund when entered hospital. Bloody fluid in peritonitis. Sigmoid twisted 180 inches and herniated through hole in mesentery about 50 centimetres from cæcum. Small gut below hole gangrenous from pressure of thickened mesentery of volvulus. Adhesions between volvulus and mesentery.

CASE XXXIII.—Reported by Jos. R. Judd.<sup>7</sup> History.—Severe abdominal pain and vomiting for three days. Operation.—Aspirated distended colon and reduced hernia. Closed defect. Findings.—Opening one inch diameter through which transverse colon passed. Result.—Recovery. Remarks.—Probably a congenital opening.

CASE XXXIV.—Reported by Little.<sup>3</sup> Findings.—Strangulation from slipping of gut through hole in mesentery.

CASE XXXV.—Reported by J. H. Hommes.<sup>8</sup> Male, five years old. History.—Abdominal pain, vomiting, and constipation of five days' duration. Operation.—Resection and lateral anastomosis of small intestine. Findings.—Cloudy straw fluid. Bluish-red intestinal loops through opening in mesentery. Results.—Died three hours post-operative. Remarks.—True ileocolic artery missing.

CASE XXXVI.—Male, sixteen years old. History.—Sharp pain in right lower quarter of sixteen hours' duration. No flatus since onset. Operation.—Reduced hernia. Findings.—Intestine loops gone through hole in mesentery 15 centimetres long and fallen into pelvis. Pathology.—No other openings. Result.—Recovery.

CASE XXXVII.—Reported by Smith. Female, twelve years old. History.—Sudden severe abdominal pain with vomiting for two days. Constipation. Operation.—Not done. Patient died forty minutes after walking into hospital. Pathology.—Volvulus of sigmoid,

ARTHUR MORTON SMITH

which had passed through hole in mesentery near cæcum, had gone through hole twice and carried with it the ileum attached to portion of the mesentery where the opening was located. Result.—Died.

The diagnosis usually made in this condition is intestinal obstruction. Several cases, including the one reported, were diagnosed acute appendicitis. In no case was the condition diagnosed before operation.

The mortality is high, over 50 per cent. Of known end-results of thirty-one cases, sixteen died and fifteen recovered.

The symptoms in the majority of cases began three or four days before operation.

As to the type of operation, there were fifteen reductions with thirteen recoveries, and of seven resections only two recovered. If resection is necessary, it is best to do a two-stage operation. All those in which resection was done died except where a two-stage operation was performed.

Bloody fluid was present in the peritoneal cavity in many instances and various degrees of obstruction from simple mechanical obstruction without interference with the blood supply to strangulation volvulus and gangrene occur. In one case there was gangrene of the sigmoid and a portion of small gut.

The size of the opening varied from five-eighths of an inch to five inches. Most of the apertures were circular, a few slit-like, and only two of them were apparently of recent origin (Brown<sup>4</sup> and Long<sup>9</sup>).

In the case reported by Long<sup>9</sup> the herniation apparently occurred during intra-uterine life. It was the only case in which more than one opening in the mesentery was found but it was not possible to determine whether these were due to congenital defects or intra-uterine tearing. Certainly trauma had added to the extent of the fenestration during or after birth because the normal development of the intestinal wall could not have taken place with such an extensive loss of mesentery and blood supply as was found at autopsy. The extreme distention of the strangulated bowel may have torn the delicate mesentery, thus enlarging the opening in this case.

The age varied from the newborn to seventy-three years. The majority (eighteen of which the age is stated) were in patients less than twenty years of age.

Twenty males and nine females were affected on a ratio of about two to one.

Previous attacks of abdominal pain were mentioned in nine cases and a history of trauma was given in only seven cases.

*Conclusions.*—(1) A case of hernia of the sigmoid and a loop of ileum through an opening in the mesentery of the small intestine with gangrene of the herniated bowel is reported. The sigmoid was twisted on itself one hundred and eighty degrees.

(2) This condition is uncommon, only thirty-seven cases having been reported.

(3) The symptoms are those of intestinal obstruction, although some

## INTRA-ABDOMINAL HERNIA

cases have been diagnosed acute appendicitis as in the case reported. Early diagnosis and operation offer the only hope of recovery.

(4) If resection is necessary, it is safer to do a two-stage operation, resection, and drainage, and later anastomosis of the bowel.

(5) The mesenteric defect is in most cases probably congenital in origin, although trauma may be a cause in some.

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# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY

STATED MEETING HELD FEBRUARY 24, 1932

The President, DR. JOHN DOUGLAS, in the Chair

### UNUSUAL COMPLICATION IN A CASE OF MAMMARY CANCER; WELL ELEVEN YEARS

DR. FRANK E. ADAIR presented a woman, white, single, who came to the Memorial Hospital August 24, 1920, at the age of fifty-three years. Two months previously she had noted a small lump in the lower inner quadrant of the right breast. It was painless at first but as it increased in size it grew somewhat painful. The tumor was bulky, measuring ten by ten by ten centimetres. It protruded against the overlying skin and there was impending ulceration. The right axillary nodes were enlarged but clinically not positively involved with disease. Two low-voltage X-ray cycles were delivered to the right breast, right axilla and right supraclavicular regions during August and September, 1920, totaling ten treatments. Under irradiation the tumor diminished to approximately four by four by four centimetres. The chest plate was negative for metastasis. February 19, 1921, a radical amputation was performed. Doctor Ewing reported the tumor to be a "cellular plexiform carcinoma with cords of large clear cells. Many appearances are possible X-ray effects. These include general hydropic degeneration of cells; isolated foci of necrosis; general fibrosis in many areas; mucinous degeneration of stroma; round-cell foci; large areas of necrosis and infiltration by polymorphonuclear leucocytes. The lymph-nodes are free of disease."

The wound was left open and a skin graft performed three weeks later. It healed over promptly. (Fig. 1). Probably on account of the skin graft, no post-operative X-ray cycle was given. Three months following the operation the patient got an infection of the middle finger of the right hand with lymphangitis extending upward over the arm and right back. She recovered from this infection. During the past eleven years the patient has been observed every three to six months. There has never been any recurrence of the carcinoma to date. The patient returned to the Breast Clinic February 1, 1932, presenting a tender swelling over the third and fourth ribs at the site of the previous operation. It clinically suggests a periostitis or osteomyelitis of these ribs. X-ray plate made of the chest reveals no evidence of recurrence or tuberculosis present. Tangential view of the chest shows definite erosion of the ribs, especially the second, third and fourth on the right side at the site of the former operation. A fluctuant area developed at this site. The patient was taken to the operating room and a small incision made for drainage. About ten cubic centimetres of thick pus were evacuated. Culture was taken. The culture showed *Staphylococcus albus* and *aureus*. The reporter said that this case was unique in his experience. The patient had no injury to cause this. The irradiation given eleven and a half years ago was very light in comparison with the treatments

## EXTENSIVE SQUAMOUS CARCINOMA

by the high-voltage machines delivered today; so that trauma and irradiation could be ruled out as causative factors of the osteomyelitis. Even though a skin graft was performed eleven years ago it is difficult to conceive of any possible infection at that time breaking out at this late day.

In this case one could anticipate this result of an eleven-year cure because no nodes were involved at the time of the operation. In such cases a cure is obtained following radical mastectomy in 70 to 80 per cent. in most good surgical clinics. In a group taken as a whole in the report of a years ago\* on 199 cases of operable mammary carcinoma, he found 40.6 per



FIG. 1.—Showing the area of the skin-graft at which site eleven years later an osteomyelitis of the second, third and fourth ribs developed.

cent. living over five years treated by combined irradiation and surgery; while of those treated by irradiation alone (thirty-seven cases), 36.3 per cent. were alive over five years.

### EXTENSIVE SQUAMOUS CARCINOMA TREATED BY INTERSCAPULO-THORACIC AMPUTATION; WELL EIGHT YEARS

DOCTOR ADAIR presented a man who came to the Memorial Hospital August 7, 1923. He presented in the right interscapular region, a flat, raised,

\* Adair, Frank E.: The Results of Treatment of Mammary Carcinoma by Surgical and Irradiation Methods. *ANNALS OF SURGERY*, March, 1932.



indurated, ulcerated neoplasm the size of a twenty-five-cent piece. In the right axilla was a mass which was fixed to the chest-wall. From this mass a sinus was discharging. A biopsy from the axillary mass revealed squamous carcinoma. Chest plate was negative for lung metastasis. The patient was treated in the X-ray department by seventeen low-voltage X-ray treatments over the back and axilla for a period of eight months. During this time the axillary mass so bound the arm to the side that it was impossible to give effective X-irradiation. October 18, 1924, Doctor Adair made an interscapulo-thoracic amputation with an especially wide skin excision to include the epithelioma of the back as well as the bulky axillary mass adherent to the chest-wall. (Fig. 2.) By this procedure it was not possible to completely close the wound over the ribs in the region of the former axilla. A skin graft was done to cover the defect.



FIG. 2.—Shows the amputation of the right arm and shoulder girdle; also the mass above the first rib. The latter has been inactivated by interstitial radon and external irradiation.

DOCTOR EWING'S pathological report was: "The specimen consists of an arm amputated to include the shoulder girdle. The axillary fold is the site of a carcinomatous ulcer ten centimetres long by five centimetres broad and in places five centimetres deep. It invades the pectoral muscle. Squamous carcinoma."

The patient had an uneventful post-operative recovery.

During the course of the next ten months several discreet nodes developed in the right supraclavicular region immediately above the first rib. During the next year this area was treated with four high-voltage X-ray treatments. October 16, 1925, under novocaine anaesthesia, the skin over the cervical mass was incised and ten gold tubes containing radium emanation were scattered through the mass, totaling 1,310 millicurie hours. The mass subsequently became densely fibrosed and has gradually diminished in size.

In April, 1930, the patient returned to the clinic presenting a mass measuring four by four by four centimetres in the left interscapular space. This mass was widely excised with its overlying skin, assuming they were dealing with a metastasis. It proved to be a sebaceous cyst. Today, the chest is still

## SKIN GRAFTING IN CASES OF SEVERE BURNS

negative for metastasis and there is no local or distant signs of any active disease eight years later.

DR. HENRY H. M. LYLE said that there was an unusual feature about this case. Examination of the spine shows lateral scoliosis to be absent. In the Depot of Ampute, just outside of Paris, in 1915, he had, through the kindness of Professor Tuffier, the privilege of examining several cases of interscapulo-thoracic amputations: they all had marked lateral scoliosis. The same has held for a few cases Doctor Lyle has seen since. In Doctor Adair's case could it be that the resultant fibrosis of this area and the X-ray treatment had counterbalanced the loss of the shoulder girdle and arm? The pull of the fibrous tissue was against the weight of the remaining arm.

### INTRAPELVIC NEUROGENICAL SARCOMA IRREMOVABLE AT OPERATION. TREATED BY IRRADIATION. WELL TWO AND A HALF YEARS.

DOCTOR ADAIR presented J. O'S., a boy of thirteen years, who was referred to the Memorial Hospital Clinic October 14, 1929, from St. Vincent's Hospital, which he had entered because of incontinence of urine, painful micturition, no defecation for a week, sharp pain in the right upper thigh and the presence of a suprapubic mass. X-ray plates revealed the presence of a large mass filling the true pelvis and extending to the level of the fifth lumbar vertebra. The bladder was displaced entirely out of the true pelvis. The diagnosis of a retroperitoneal sarcoma was made, and an exploratory laparotomy was done August 24, 1929. The operation revealed a large mass extending from the true pelvis up into the abdomen, nearly to the level of the umbilicus. This mass appeared to be retroperitoneal but its point of origin could not be determined. It was soft; the tumor was aspirated and a section taken. It was then packed and the abdomen drained. The microscopical report on this material was "a very cellular neurogenic-sarcoma." The patient was then referred to the Memorial Hospital. On admission he was a very sick boy in bad general condition. The eight high-voltage X-ray treatments were begun October 8, 1929. He immediately commenced to improve. The mass began to diminish. By November 4, 1929 (one month later), he had gained nine and one-half pounds. The sinus was nearly healed and the suprapubic mass was rather indefinite to palpation. By December 23, 1929, no tumor was palpable. By March 2, 1931, a new mass had appeared in the left groin and the urine was offensive. Four X-ray treatments were instituted. Both the mass and the symptoms promptly disappeared. He is now entirely free of disease as far as one can make out symptomatically or on rectal examination. It is now two and a half years since his admission as a hopeless case.

This type of case must be observed frequently and therapy instituted at once if there is any sign of recurrence. The reason for the great success of irradiation therapy in this case is probably dependent on the youthfulness of the patient and the extreme cellularity of the tumor. The more cellular the tumor, usually, the more striking is the irradiation response. This illustrates the value of irradiation in a case of neurogenic sarcoma where it was impossible to treat by any known surgical measures.

## SKIN GRAFTING IN CASES OF SEVERE BURNS

DR. FENWICK BEEKMAN presented four patients, three boys and one girl, to demonstrate the fact that it is possible to prevent contractures due

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to scar tissue in severe burns and in cases in which the skin has been avulsed from large areas of the body, if immediate skin grafting is done. Two of these patients had been treated in this manner and were entirely free from contractures. In contrast, two other patients were presented, one of whom had a severe contracture of the knee and the other a contracture of the axilla and the cubital fossa. In both of these cases he believed that the contractures could have been prevented if they had had early skin grafting.

The most satisfactory type of skin graft is the full-thickness pinch graft, the grafts placed sufficiently close to each other to allow the surface between to heal within a week or ten days.

CASE I.—A boy, November 16, 1925, when ten years of age, was run over by a bus, the entire skin of the left leg being avulsed from the knee to the ankle, cleanly exposing the muscles, bones and vessels below the deep fascia. The wound was cleaned



FIG. 3.—Third-degree burn of complete circumference of leg from above ankle to inguinal region. Early pinch grafting. No contracture. Case II.

and the edges of skin débrided. He was treated by the Dakin method until the 18th of November, when the limb was placed in a hot-air tent, as a burn would be treated. There was surprisingly little infection. On December 18, the granulations being healthy, the popliteal space was grafted with about 175 pinch grafts. These having taken, a similar number were applied on the 12th of January, 1926, and others ten days later. The boy was discharged from the hospital, some three or four months later, with his leg practically healed. On March 24, 1928, three years later, he was re-admitted because of an ulcer of the skin, which would not heal, situated on the patella. The pre-patellar bursa which lay beneath the ulcer was excised and the wound skin grafted, following which it did not break down again. At present, he has healthy, elastic skin which seldom breaks down. He has a fair amount of motion at the knee-joint and can do almost anything the other boys do.

CASE II.—A boy, five years of age, on October 29, 1929, was burned by a bon-fire and was immediately brought to the Hospital for the Ruptured and Crippled. His left

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leg was burned from the ankle to the scrotum and buttocks. The left side of the abdomen and face were also involved. These latter burns were of second-degree intensity and left little, if any, scar. On the left leg, from just above the ankle to just below the trochanter, the skin for the entire circumference of the limb was destroyed through its full thickness.

The burns were treated with 5 per cent. tannic-acid solution. A satisfactory tan was obtained and on December 3, 1929, exactly five weeks following the accident, the tanned eschar having completely separated and the granulation tissue being extremely healthy, he was subjected to skin grafting. At this time, 150 full-thickness pinch grafts were removed from the opposite thigh and placed in the popliteal space, each graft being placed about one-eighth of an inch from its fellow. The grafts were covered with strips of paraffin gauze and a few layers of dry gauze. The remaining portion of the granulating surface was dressed with strips of vaseline gauze and covered with dry gauze. The entire leg was then surrounded by coarse non-absorbent cotton, which was firmly bandaged in place and covered with strips of adhesive plaster, crossing each other, to give additional pressure. The entire limb and hip were mobilized in a plaster casing. In a week's time the dressings were removed and the grafts were found to have taken.

December 13, 1929, ten days after the first grafting, a second was performed, the inside of the leg and thigh being covered with 150 additional grafts; and December 28, 1929, the third operation took place, the remaining external surface of the leg and thigh being covered with 150 grafts. All the grafts took, and, by the first of February, the entire lower surface of the leg was covered. The patient was discharged from the hospital April 5, 1930. Following this, an occasional ulceration developed which, however, was healed by ordering the child to bed. In July, 1931, he had an ulceration over the patella but, by means of rest, this was healed. His leg is now covered with a soft, pliable, elastic skin (Fig. 3) which does not break down, though the boy takes no particular care to prevent accidents. There is full range of motion at the knee-joint.

CASE III.—A boy, six years of age, June 5, 1930, had his clothes catch fire from a bon-fire and his entire left leg and thigh were burned. He was taken to a hospital where he was treated by means of sodium-bicarbonate dressings. Though the entire circumference of the leg lacked skin from just above the ankle to above the knee, no skin grafting was done. Consequently, the granulating surfaces slowly epithelialized from their edges and there developed a contracture. This patient was referred to the reporter May 12, 1931, almost a year following the accident. He was admitted to the Hospital for the Ruptured and Crippled. His left leg was then contracted at the knee to a right angle, a large, pale web of scar tissue having formed between the back of the thigh and the calf of the leg. The skin covering this area was thin and non-elastic and shiny. On the inner side of the leg there was an ulcer, measuring four by two inches, with a base composed of shiny, smooth, pale granulation tissue. The child, of course, was unable to walk. For a week, the leg was treated with wet dressings, by which the inflammation was reduced. May 20, 1931, eighteen days following admission, the floor of the ulcer was excised down to normal fascia. This area was covered with 150 pinch grafts. Ninety per cent. of these took and, in another week's time, the entire bare area was healed. August 19, 1931, the contracture was operated upon, the posterior surface of the thigh being incised transversely at the upper edge of the web. This incision was deepened and lengthened, as the knee was extended by an assistant, until normal tissue was reached. It was found that, by gradual pressure, the structures on the posterior surface of the popliteal space could be stretched and the leg straightened. The upper edge of the skin of the web was thereby drawn down to the mid-calf, leaving a diamond-shaped wound, measuring eight by four inches, which exposed the normal structures of the popliteal space. The tendons and nerves were exposed in many places, as the deep fascia had been destroyed. The upper border of this wound was composed of undamaged skin and the lower of scar tissue. A full-

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thickness skin graft, measuring eight by four inches, was removed from the opposite thigh and sutured in this opening and the wound was dressed with gauze. The leg was wrapped in non-absorbent cotton, tightly bandaged and immobilized in a hip spica. The wound on the right thigh, from where the grafts had been obtained, was sutured, but this broke down in three or four days and the edges separated. September 1, twelve days following the operation, the plaster casing and dressings were removed. It was found that the entire Wolff graft had taken and that the leg was straight. A week later, the child was allowed to walk, as the deeper tissues of the leg were commencing to contract. The upper edge of the scar, which was healed to the lower border of the Wolff graft, ulcerated. September 16 this ulceration was excised and the raw area covered with pinch grafts, which healed. As the deeper tissues were contracting, the leg was placed in a plaster casing. The boy was discharged from the hospital October 14, 1931, wearing a brace to prevent the contracture of the knee. January 9, 1932, he was re-admitted to the hospital, as the old skin which covered the area upon the leg which had not been grafted had broken down and formed chronic ulcers. The knee, at this time, was found to be straight. This ulcerated area was excised down to normal fascia and pinch grafted. These grafts are seen to have healed. The patient now has full motion at the knee. There are no signs of contracture and the only complaint that he has is the breaking down of the poor epidermis covering the ungrafted area of the leg.

CASE IV.—A girl, aged eight years, was admitted to Bellevue Hospital June 2, 1931, with a third-degree burn which covered the upper part of the back of the trunk and both arms. The burn was treated by means of tannic acid but was not skin grafted. The areas of granulation tissue finally became covered with skin, the epithelium having extended in from the edges of the wound. She was discharged November 8, 1931, five months after admission, healed, but with some contraction of the left axilla and left elbow. She was re-admitted December 5, 1931. At this time the elbow could not be extended beyond a right angle and the arm could not be abducted more than forty-five degrees from the chest-wall. November 5, 1931, at the time of the meeting of the New York Surgical Society at Bellevue Hospital, the elbow was operated upon. A transverse incision was made across the upper edge of the web and carried down to normal tissue. At the same time the forearm was extended at the elbow. This left a triangular area, exposing the structures in the cubital fossa, about three inches long and two and a half inches wide. A full-thickness graft was removed from the opposite thigh and sutured into the space. The wound was dressed with gauze and non-absorbent cotton to produce pressure and the entire limb was encased in plaster. When dressed on the tenth day, the entire graft was found to have taken. January 4, 1932, a plastic operation was performed upon the axilla. The web formed an accentuation of the posterior axillary wall. Two flaps were formed by means of an incision in the form of an inverted Z, the oblique portion of the incision being made on the crest of the web. The upper flap, which was composed of more or less scar tissue, was transferred to the position of the lower flap. The lower flap, which contained healthy skin and subcutaneous fascia, was transferred to the position left vacant by the upper. The upper flap healed without difficulty, giving a healthy, soft skin for the axilla. The lower flap broke down and this area, on February 5, 1932, a month following the plastic operation, was covered with pinch grafts, which took. The child now can extend her elbow to about 170 degrees and can abduct her arm to about 120 degrees.

DR. CARL G. BURDICK said that he had experienced so much difficulty in handling these cases in the past in the effort to get them in condition for some form of grafting that he especially appreciated the results in Doctor Beekman's cases. With pinch grafts one is sure of getting enough skin to cover almost any area. Using tannic-acid treatment first one can get these



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patients in condition for grafting fairly early and with Dakin's solution they can be cleaned up in a short time and graft them before contracture has taken place. It is the ideal method of treatment and when the pinch grafts are placed close together one gets the same result as with full-thickness grafts over the entire limb.

DR. KIRBY DWIGHT said that the great advantage of pinch grafts is their resistance to the wear and tear of use; they are not so apt to suffer from abrasions and contusions as Thiersch grafts. Another point is the great importance of doing the grafting early. Waiting until it is evident that the skin cannot be covered with skin in any other way is a mistaken procedure.

DR. HENRY H. M. LYLE referred to a paper he read before this Society in 1926, entitled "Skin Plastics in the Treatment of Traumatic Lesions of the Hand and Forearm," the burden of the paper being that prompt healing is the essential requirement in obtaining functional use, and that much time and disability can be saved by the employment of suitable skin plastics. The advent of the Carrel method of treating war wounds and burns has taught that large granulating surfaces can be quickly sterilized and that they then can be covered by skin grafting with the assurance of a high percentage of takes. The closure can be obtained by primary or secondary skin grafts. Once having obtained an epithelial covering one is in a position to carry out any reparative procedure that may be indicated. When lesions involving a large destruction of skin are met with it is imperative that the surgeon should map out a plan that will lead to prompt healing and epithelization, having in mind the necessary procedures that will have to be employed to obtain a satisfactory functional result. To allow a large superficial wound to heal by granulation should be considered a surgical failure. Certainly it is a great economic waste.

DR. GRANT P. PENNOYER said that the most important factor in obtaining good grafts is the blood-supply to the graft. The explanation of the good results obtained from early skin grafts in burn cases is the establishment of the blood supply, which is not hindered by a heavy scar-tissue base. An important factor in skin grafting is a right amount of pressure on the fresh grafts. At Roosevelt Hospital rubber sponges are used to obtain this pressure.

DOCTOR BEEKMAN, in closing the discussion, said that one sees many bad results in burns due to lack of or improper grafting, resulting in severe contractures. It can almost be made a rule that the longer a wound remains open, the greater the resulting scar tissue. With early pinch grafting, one is enabled to heal a wound before sufficient fibrous tissue has formed to become scar tissue. Scar tissue constricts the blood-vessels; consequently, curetting the granulations down to the scar tissue is wrong; one should excise the new tissue down to a normal base. In cases in which Thiersch

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grafting has been done, the skin is not elastic. With full-thickness pinch grafts, which act as elastic buffers, the area is soft and pliable.

### TUBERCULOSIS OF THE GALL-BLADDER

DR. WILLIAM CRAWFORD WHITE presented a woman, fifty years of age, who was admitted to the Roosevelt Hospital March 5, 1931, with a three months' history of attacks of gall-stone colic. Physical examination was essentially negative. Intravenous dye failed to visualize the gall-bladder. No gall-stones could be demonstrated. Gastro-intestinal X-ray examination showed no pathology. At operation, March 12, 1931, the common bile-duct was found dilated and contained a spherical gall-stone about 3.5 centimetres in diameter. This was acting in a ball valve fashion. The gall-bladder was small, somewhat shrunken and had a growth on its fundus that suggested malignancy. Throughout the liver substance in the neighborhood were many punctate areas which suggested possible metastases. Through an upper right rectus incision the abdomen was explored. The common duct was opened and the gall-stone removed. The duct was then drained. After this the gall-bladder was removed and the cystic duct tied off.

The report from the pathological laboratory was:

*Gross.*—Gall-bladder measures seven centimetres in length and three centimetres in diameter at the fundus. The serosa of the fundus is thick and has a nodular furrowed appearance. It is resilient and firm on palpation and is covered by shining, opaque, yellowish-white serosa. The wall is thickened, averaging five millimetres. At the fundus the mucosa is ulcerated and has a granular rough surface with yellowish-brown excavations extending well into the wall. These are covered by hæmorrhagic exudate. The mucosa in the body of the gall-bladder and toward the duct outlet is smooth but the wall is markedly thickened.

*Microscopical.*—The gall-bladder mucosa is of normal type, single-layered epithelium. In the wall are masses of granulation tissue with monocytes and giant cells. Some typical tubercles are present. Attempts to demonstrate tubercle bacilli by staining were not successful.

*Diagnosis.*—Tuberculosis of the gall-bladder.

DOCTOR WHITE added that at operation he had been convinced that he was dealing with a carcinoma of the fundus of the gall-bladder, with minute metastases to the adjacent liver. The gall-bladder was removed largely because of his desire for a confirmation of his diagnosis. Consequently, no culture was thought of until it was too late, so that the complete proof is lacking. To date the patient has had an uneventful post-operative course.

### PARATHYROID TETANY FOLLOWING SUBTOTAL THYROIDECTOMY

DOCTOR WHITE presented a man, thirty-one years of age, who was admitted to the Roosevelt Hospital August 7, 1928, with an eight months' history of exophthalmic goitre. Weight, 190 pounds. Basal metabolism, plus 44, although clinically he was much sicker than the test would indicate. A two-stage procedure was decided upon. One stage was performed on August 19, and the second stage on October 1, 1928. The parathyroid glands were not noted at the pathological laboratory. A report of toxic thyroid gland tissue was made. On the third day after the second operation the patient complained of cramps in both hands and both feet, duration a few minutes with relief obtained by massage. After discharge from the hospital, the symptoms persisted and he developed great weakness in his

## PARATHYROID TETANY FOLLOWING SUBTOTAL THYROIDECTOMY

legs, so that he climbed stairs only with assistance. He was given 150 grains of calcium lactate a day, and after two weeks his blood calcium was 6.2 milligrams per 100 cubic centimetres. The dosage was raised to 200 grains of calcium lactate with a resulting blood calcium of 7.4. With the aid of an ampoule of parathyroid extract (Collip) per day, in addition, the blood calcium went up to 7.7 milligrams per 100 cubic centimetres (normal 9 to 11). The 200 grains of calcium lactate a day did not bother his appetite but gave him two or three loose stools per day. He had some improvement from this treatment. He complained especially of spasm in the hands when excited or when a sudden loud noise was heard. January 31 (about four months after operation), his blood calcium had dropped to 5.6 milligrams per 100 cubic centimetres. Dr. William Ladd, who took charge of him shortly afterward, gave him a high-calcium diet, calcium lactate, and parathyroid extract (Collip) every day for two months, then every other day for three months, and since then he has taken it every two weeks.

At present he weighs sixty pounds more than at the time of the operation, has a basal metabolism of minus 8 and blood calcium of 6.5 and feels fairly well. He no longer has spasms of his hands or feet, but complains of numbness at times in his legs which also feel, at times, like two sticks, and at these periods he loses all pep. He then takes an ampoule of parathyroid extract (Collip), and thirty-six grains of calcium lactate per day for a few days, after which he feels much better.

This man was presented as a case of mild post-operative thyroid tetany that failed to respond to calcium lactate alone, or parathyroid extract in association. His real improvement came about when the high-calcium diet was added.

DR. CHARLES GORDON HEYD remarked that as a complication of thyroidectomy tetany is neither infrequent nor rare. Not many parathyroids are actually injured during the course of a thyroid operation, nor with modern resection technic are they removed with the thyroid tissue, but what does happen, however, is that their blood-supply is frequently very seriously compromised by the manner and location at which the inferior thyroid artery is ligated.

It is readily possible to recognize two types of tetany as they occur after operations on the thyroid. It is not an infrequent experience to find a patient, twelve to fourteen hours after a subtotal thyroid resection, complaining of pain in both arms, midsternal pain, and peculiar tingling or formication of both upper extremities and occasionally a marked weakness in the lower extremities. Rarely, one does see at the end of twenty-four hours after operation a marked case of tetany with a typical accoucheur's hand. This group represents a transient or temporary form of tetany and is usually completely relieved before the patient is discharged from the hospital. Occasionally, some of these transient tetany cases require active treatment and the speaker's procedure has been as follows: A blood-calcium determination is the preliminary to all therapy. If the calcium is not less than 8.5 milligrams per 100 cubic centimetres of blood serum the symptoms are not apt to be either severe or prolonged. When the calcium reaches six, five or four milligrams, then there is progressively well-marked tetany. The procedure has been to administer calcium lactate by mouth, 100 grains

every two hours, for three doses, or to give ten cubic centimetres of a 10 per cent. sterile solution of calcium lactate intravenously. The acute manifestations of parathyroprival tetany can almost certainly be prevented by parathyroid hormone (Collip). As a rule the transient type of tetany is compensated for before the patient leaves the hospital but there is a group, represented by Doctor White's case, which may be designated as chronic tetany. Is this patient to take calcium lactate for the remainder of his life? Will he have to continue on a high-calcium diet of milk, peas, beans, eggs and sauerkraut? Will he have to continue intermittently or continuously with injections of parathyroid hormone (Collip)? There seems to be a well-founded belief that the taking of calcium lactate will maintain adequate calcium metabolism. It is very doubtful if over a long period of time patients with chronic tetany can avoid occasional treatments with parathyroid hormone. In view of the effect of ultra-violet therapy on rickets Jackson has treated one of his cases with ultra-violet light therapy and was able to report substantial changes in the dosage of calcium that was required after treatment in comparison with that which was used before. The question as to the transplantation of parathyroid glands is an interesting one. A few years ago surgeons were led to believe that parathyroid tissue grew abundantly on all the surfaces of the thyroid, and many of these supposed clumps of parathyroid tissue were transplanted. Most of them proved, however, to be only aggregations of fat cells and not parathyroid tissue. The effects of the transplantation of parathyroid tissue seem to be dependent upon the length of time that the graft survives in its new resting place, and the beneficial effects of the transplantation seem to be only temporary depending upon the time that is required for the transplant to be absorbed. It seemed to him that the progress made in Doctor White's case is very significant as a prognostic factor and that this patient should eventually work out of his tetany.

DR. WILLIAM BARCLAY PARSONS, JR., said that he had found that the use of powdered form of calcium gave better results than the tablets, particularly in one chronic case where a prompt improvement followed this change in the form of medication. He did not feel that it would be advisable for Doctor White's patient to attempt any definite reduction in weight through diet. The speaker has followed Lahey's process of inspection of the specimens and the removal of any suggestive pieces for reimplantation in the neck. Usually such pieces have been found to consist of fat; but on two occasions parathyroid tissue was found. These patients, however, showed no symptoms of parathyroid deficiency. Laboratory and clinical cases do not favor the attempt at transplantation of parathyroid from one individual to another, particularly as the majority of cases, after the use of parathyroid hormone and calcium by mouth, will subside spontaneously.

DR. EDWARD W. PETERSON referred to a case of congenital goitre which he presented before this Society about four years ago. The patient at that

#### FRACTURE OF EPIPHYSIS OF THE HEAD OF THE FEMUR

time was a young woman twenty-three years of age. When five weeks of age she was admitted to the Post Graduate Hospital because of a large tumor in the right side of the neck which was diagnosed as lymphosarcoma, although there were no symptoms aside from the deformity. Under the impression that the diagnosis was correct, Doctor Peterson removed the tumor. It was made up of two masses, both of which had a slightly irregular, lobulated appearance, joined by an isthmus of fibrous tissue. Convalescence was normal, except for a brief rise in temperature to  $105^{\circ}$ , until the ninth day when symptoms of tetany appeared. At this time the pathologist reported the specimen to be a congenital thyroid tumor. Believing that the whole thyroid gland had been removed, thyroid extract was administered which was followed by a cessation of the tetany. The thyroid feeding was kept up for the first four years of the patient's life and since then, at regular intervals, thyroid extract and iodine have been given. Mental and physical development were perfectly normal up to the age of puberty, at which time a slight enlargement developed in the left side of the neck, corresponding to the left lobe of the thyroid. Microscopical sections from both specimens showed the same structure as that of the thyroid gland. The acini show a slight adenomatous proliferation but the epithelium does not show any malignant proliferation.

DR. J. WILLIAM HINTON said he had a patient who developed tetany in April, 1925, which was controlled with calcium chloride, intravenously, every day for a period of six days, then every two or three days for another eight days, after which time the patient left the hospital and was seen in his office at weekly intervals for two months when on each visit calcium chloride grains  $15\frac{1}{2}$  was used intravenously. Then every two weeks for another two-month period.

At the onset of the symptoms immediately following operation Collip's parathormone would not control the symptoms. After September, 1925, the patient was symptom-free and remained perfectly well until January of this year, when she complained of over-weight. Basal metabolism done at that time was a minus 3, and the patient was advised to take thyroid extract grains  $1\frac{1}{2}$ , thyroid iodine dosage. Two days after thyroid medication was administered the patient had a return of her tetany. Thyroid extract was immediately discontinued and the patient's symptoms disappeared and she is now symptom-free.

This patient has had a low-calcium threshold, her calcium having gone to 6.5 while in the hospital, and it has remained under 8, although she had no symptoms seven and one-half years, until thyroid extract was administered.

#### FRACTURE OF EPIPHYSIS OF THE HEAD OF THE FEMUR

DOCTOR WHITE presented a boy who, in July, 1930, when fourteen years of age, hurt his left hip while playing baseball. He was unable to raise himself from the ground. X-rays showed a fracture dislocation of the epiphysis



of the head of the left femur, with displacement upward of the distal fragment. Under ether anæsthesia the fracture was reduced by the surgeon in attendance, and a Whitman hip spica was applied. He was kept in the casting for forty-two days. Measurement at this time showed a shortening of one inch of the affected limb. Another spica was applied with the thigh in 45 degrees abduction, 15 degrees flexion and internal rotation. This was kept on until November 10 (over four months). He then was instructed to use crutches for two months more without weight-bearing. One year later he had three-eighths of an inch shortening of the left lower extremity with slight atrophy of the thigh. The left thigh flexed only 80 degrees, and he walked without a limp. No limitation other than that of flexion. In the reporter's opinion, in this case the head of femur slipped some after the limb had been placed in an abduction spica. The original reduction had been excellent but not complete. If a similar situation arose again, he agreed with Cotton that an accurate reduction is indicated. If the closed method does not succeed, an open and accurate reduction is indicated in these adolescents.

DR. MATHER CLEVELAND (by invitation) said that Doctor White's case illustrates the excellent functional results that can be obtained without perfect anatomical results. These cases usually occur in patients from twelve to fourteen years of age as opposed to Perthes' disease, in which the age incidence is considerably younger. These two conditions, slipping of upper femoral epiphysis and Perthes' disease, seem to be allied. This case of slipping of the upper femoral epiphysis is of the traumatic type. There is another type which occurs from such an accident as stepping off a curb stone which may be disregarded for weeks and months until a limp is noticed. This may be bilateral with a very mild trauma. Doctor Cleveland showed some X-ray films of a patient with this second type who came to the hospital with a slipping of the femoral epiphysis. There was no severe trauma but six months previously she jumped off a step two feet high and the hip and leg hurt. She did not limp much at first but this symptom increased. Seen six months after this accident the slipped epiphysis was reduced and over-corrected. She was put in double plaster-of-Paris spica and then in a single spica. She was kept in plaster six months; during the last two months she was walking. Healing took place through absorption of the epiphyseal line. The union remained solid. Doctor Cleveland said he agreed with Doctor White that replacement should be obtained even if open reduction is necessary. This is to be accompanied by long immobilization.

DR. FENWICK BEEKMAN said he had seen two cases of slipped epiphysis of the neck of the femur in children. One was reduced and put up in a Whitman hip spica. In the other case, seen last autumn, the child had become gradually lame, following a slight jolt which she received in stepping off a pavement. A slipped epiphysis was shown by röntgenograms. It was decided to reduce this by means of traction. The child was put up with Russell traction on both legs, which were placed in full abduction. In a week's time, the epiphysis had almost returned into place. Finally, at the

## DIVERTICULITIS OF SIGMOID; CARCINOMA OF SIGMOID

end of three weeks, there was complete reduction of the epiphysis upon the neck.

DR. SETH M. MILLIKEN referred to the case of a boy, thirteen years of age, who, while riding a bicycle, put his foot down for a sudden stop and felt a little pain. He went to the hospital three weeks later. The neck was found to have slipped off the head about one-fourth. He was put up in traction of about 30 degrees for one night, which reduced the displacement. The weight which held the head and neck in place was then diminished for four weeks, at the end of which time there was no further trouble. In six months he was walking without a limp. Traction is more comfortable than a spica.

## DIVERTICULITIS OF SIGMOID; CARCINOMA OF SIGMOID

DR. HERMANN FISCHER presented a woman, sixty-five years old, first seen in the fall of 1930. At that time she complained of constipation, with alternating diarrhoea, and off and on blood and mucus in the stools. She had cramp-like pains in the abdomen, had lost some weight and strength. She brought an X-ray film along which showed a well-developed diverticulitis of the sigmoid. She was advised to enter the hospital for further examination, which advice she did not follow until June of the following year. She was then much sicker than before.

On admission she gave the following history: She was in excellent health until two years ago, weighed 175 pounds, did moderately heavy manual labor. At that time she began to lose her appetite gradually and then weight until she dropped to a weight of 126 pounds. She hardly eats at all. She has been constipated all her life, but more so during the past two years, and lately she has had to take cathartics continually to make her bowels move. She had occasional bleeding from the rectum, always red blood, usually between bowel movements, never profuse. This bleeding has been intermittent for the past two years.

Two days ago after a small bowel movement she began to have severe abdominal cramps over the entire abdomen, but much more severe in the left lower quadrant. She had had similar attacks, gradually getting worse, in the last two years.

She has been well all her life before this trouble started. She was a well-developed, fairly well-nourished woman, not acutely ill, who has evidently lost some weight. Rather pale. No jaundice, no gross deformity. Pulse, 96; temperature, 101°; respiration, 24; blood-pressure, 180/100. The abdomen was slightly distended and tympanitic throughout. No organs or masses or herniæ present. Quite distinct tenderness on deep pressure over the region of the sigmoid but no distinct tumor can be palpated.

*Rectal Examination.*—Mucous membrane smooth. No mass or ulceration as far as the examining finger can reach. There is, however, some pain when the finger presses against the anterior wall of the rectum.

*Vaginal Examination.*—Uterus small, anteverted. There is an irregular mass, painful on palpation in the posterior fornix. This mass is not movable and seems to be tightly adherent to the posterior wall of the uterus and filling the whole Douglas' pouch.

*Blood Examination.*—3,300,000 red corpuscles; hæmoglobin, 65 per cent.; leucocytes, 9,600; polymorphonuclears, 82 per cent.; large and small lymphocytes, 17 per cent.; eosinophiles, 1 per cent.

*Urine.*—1.014, cloudy. Albumin, plus. Sugar, negative. No casts.

*X-ray Examination.*—The barium clysma was rather unsuccessful as the patient was unable to retain the fluid until the upper colon was outlined. However, the colon, from the splenic flexure downwards, is well outlined with barium, and there is definite evidence of a diverticulitis in the sigmoid region. There is considerable distention of the coils of small intestine. This is probably due to some obstruction. The re-examination after forty-eight hours shows almost complete evacuation of the colon, with traces of barium in the diverticula.

*Operation.*—June 17, 1931, suprapubic mid-line incision from symphysis to umbilicus. On opening the peritoneal cavity there appears a moderate amount of clear peritoneal fluid. The great omentum is somewhat congested and its free border is firmly adherent to the cæcum, bladder, and sigmoid, covering the contents of the pelvis completely. The sigmoid flexure and the transverse colon and all of the loops of small intestine are greatly dilated due to an inflammatory adhesion between the mid-portion of the sigmoid, loops of intestine in the pelvis and the posterior surface of the uterus. The appendix is also caught in this mass.

The peritoneal adhesions are separated by sharp and blunt dissection, freeing the cæcum first. The appendix is removed. When the loops of small intestines are separated from the sigmoid an abscess containing about an ounce of foul creamy pus is evacuated. The sigmoid flexure can now be freed and a large and irregular tumor mass is found, practically taking in two-thirds of this part of the bowel. The mesentery of the sigmoid is then tied off and the loop of the intestine brought out of the abdominal cavity. It is then resected. The upper stump of the bowel is sutured to the upper angle of the wound and the lower stump to the lower angle of the wound. A cigarette drain is inserted into the pelvis below and above the lower loop of bowel and the incision sutured in layers around the opening of the gut. A Paul's tube is sutured into the upper opening of the gut for drainage and a dressing applied. The patient made an uneventful recovery and left with a well-working colostomy after a five weeks' stay in the hospital.

She re-entered the hospital again on the 27th of September, 1931, to have the colostomy wound closed and the bowel-lumen reconstructed. *Second operation.*—September 28, 1931, under spinal anaesthesia (neocaine 0.120) an elliptical incision is made around each of the two colostomy openings, separating the bowel from the skin. Each of the openings is closed by a tobacco-pouch inverting suture. After having thus insured an aseptic operative field, the colon is separated by blunt and sharp dissection from the adjacent tissues and adherent loops of intestine for the purpose of mobilization. The ends of the gut are freshened and an end-to-end anastomosis is done without any difficulty. The gut is dropped back and the abdomen is closed in the usual manner. She made a good recovery and is now in perfect health. Her bowels move regularly; she has no pain or mucus or blood in the stool and has gained about thirty pounds in weight.

*Pathological report.*—The specimen consists of an appendix and a portion of the sigmoid flexure of the colon. The portion of the sigmoid measures twelve centimetres in length and six centimetres in diameter. For one-half of its length it appears normal, except for a congestion of the mucosa. In the rest of it, the mucosa is replaced by a friable, papillated, reddish tissue of gray color. The muscular walls are here much thinned out and in two places small perforations have actually occurred through the whole thickness of the attenuated sigmoid wall. At this point and for a distance of five centimetres about it, there can be seen densely adherent dark gray and brown plaques of tissue on the serosal aspect of the specimen. On the other side of this

## SPLENECTOMY FOR MOVABLE SPLEEN; TORSION OF PEDICLE

abnormal mucosa a thin strip of apparently normal mucosa can be discerned. Small diverticula can be found on probing through the more normal mucosa. On section a few phleboiths are found in wall as well as a lymph-node.

*Microscopical Examination.*—Section of the sigmoid tumor shows a typical adenocarcinoma composed of acini of various sizes lined with multiple layers of rather chromatic cells. The growth appears to be confined to the inner half of the wall. The superficial part exhibits a papillomatous structure and is extensively ulcerated. There is a marked inflammatory reaction of the stroma of the tumor and the involved gut wall. In the latter are noted numerous abscesses lined with granulation tissue which is rich in mononuclear wandering cells and giant cells. Sections of several of the diverticula show them to be lined with atrophic mucous membrane. Sections of the appendix show the usual picture a catarrhal appendicitis and acute peri-appendicitis.

## SPLENECTOMY FOR MOVABLE SPLEEN; TORSION OF PEDICLE

DOCTOR FISCHER presented a young girl who had always been in good health. Ten days before being seen the girl was suddenly seized with a severe cramp-like pain in the lower left quadrant of her abdomen. This pain persisted steadily for about a week, then it disappeared and almost at the same time the patient noted a lump in her abdomen on the left side. While she had this attack of pain she also suffered from frequency of urination during the day and night.

Her abdomen presented no hernias, no tenderness. There was palpable a large firm mass which filled up about two-thirds of the entire left half of the abdomen. The tumor had a sharp lateral border and impressed one as having the general outline of an enlarged spleen. If the patient is in the erect position, the mass slips downward into the pelvis. It can be freely moved about almost clear across the abdomen to the right side. If that is done the patient complains of a nauseating pain, probably due to stretching of the pedicle.

In order to exclude the kidneys an X-ray picture after Skiadan injection was made. This examination demonstrated normal kidney pelves and ureters. No displacement. No apparent abnormality in the entire tract.

October 16, 1931, a five-inch left upper rectus incision was made. A large spleen, approximately twice the normal size, was readily brought up into the wound. It was firm in consistency, and there were no adhesions at any point. The pedicle was markedly elongated and the spleen had been twisted around the pedicle in two complete turns, so that the venous return seemed to be partially blocked. The surface of the spleen felt smooth, the capsule was thickened, but there was no infarction visible macroscopically. In many of the veins of the hilus thrombi could be felt. The pedicle was ligated and the organ removed. There was no bleeding or oozing and the abdomen was closed in the usual manner. The patient had no reaction after the operation and made an uneventful recovery.

The case was undoubtedly a congenital movable spleen which made no symptoms until pedicle torsion occurred. It was at the time of the twisting that the severe attack of pain occurred. In spite of the twisting and the concomitant interference with circulation no great damage to the organ occurred. It seems that there was no marked interference with the arterial blood supply, only the veins showed the thrombosis.

Movable spleen is a comparably rare occurrence in children and is then most probably of congenital origin, caused by a congenital laxity of the ligaments. Moynihan, as quoted by Pool, found a spleen in a boy of twelve which was so mobile that it lay in the left iliac fossa. The acquired type is more frequent and is found almost exclusively in adults associated with other



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splenic pathology with enlargement of the organ. In these conditions the spleen becomes ectopic by its sheer weight.

### LATE RESULTS OF OPERATIVE TREATMENT OF CARCINOMA OF THE BREAST

DR. PERCY KLINGENSTEIN read a paper with the above title for which see page 286.

DR. ALEXIS V. MOSCHCOWITZ said that there is general sympathy with such efforts, as that of Doctor Klingenstein, to improve technic by studying both the bad and good results. In this connection a very significant idea creeps in, namely, that all papers of this kind are based on statistics and more or less careful follow-up. One of the big errors is that the author is so honest that he leans backward. Doctor Klingenstein demonstrated this in the statement he made that the patients lost to follow-up are classified as having died in the first year. This may be valid to Doctor Klingenstein's statistics, but what the patient wants to know is: "What are my chances for recovery?" According to these statistics the answer would be, about 23 per cent. Only about 75 per cent., however, have been followed up and there is no way of actually knowing how many of the remaining 25 per cent. are still alive. Only a small number would greatly increase the percentage of recoveries. In his own practice, Doctor Moschcowitz said he has a large number of cases of six-, eight-, ten- and twelve-year cures. Only last week he met a patient living and well seventeen years after operation without recurrence. One day afterward she died of apoplexy. The New York Surgical Society would do well not to rely on statistics but rather on personal follow-up which will undoubtedly show a larger number of cures than 23 per cent.

DR. HOWARD LILIENTHAL said that he formerly treated his cases of mammary cancer by preliminary radiation but that he found that many of the patients were made nervous by the delayed operation, so that he, therefore, employs this treatment now in selected cases only.

He believed, however, that it was most important to have the lungs examined by X-ray before deciding upon radical operation, and that probably in the future we would find it wise to examine the spine and other bones for metastases. If the X-ray should disclose metastasis it would usually save the patient from an operation. He felt quite convinced that there were cases in which metastasis had been present and probably discoverable before operation.

DR. FRANK E. ADAIR felt that the author did not do his statistical results justice. He counts as dead any case that has lived more than five years but who has a recurrence present. This is not customary in statistical studies on cancer. This fact will probably account for part of the disappointing five-year results (23 per cent.) when compared with the author's previous communication on this subject published in the ANNALS OF SURGERY in



## RESULTS OF OPERATIVE TREATMENT OF CARCINOMA OF BREAST

August, 1926, at which time he reported 34 per cent. five-year cures. It may be possible that Doctor Klingenstein is operating on cases that are more advanced than those previously. This may be justifiable in institutions where little dependence is placed on irradiation. In clinics where irradiation is intensively used the surgeon is apt to make a sharper line of operability because he is more inclined to lean on irradiation methods for that particular group of cases on the border-line of operability. Operating on the inoperable cases, except for palliation, does not redound to the good reputation of surgery.

Even today in many clinics the routine chest plate is not made before operation on a case of breast carcinoma. This should be insisted on. But the interpretation of that plate must be made by an expert röntgenologist. So many patients in the cancer age show shadows resultant from previous lesions, such as chronic bronchitis, old tuberculosis, *etc.*, that the röntgenologist of little experience, by a misinterpretation of the X-ray film, may easily deny a patient a chance of surgical cure. If clinical disease is located only in the breast, while no axillary or supraclavicular nodes are to be palpated, unless the röntgenologist is very certain of his interpretation, that patient should not be denied a radical mastectomy. Usually, with such a clinical setting, a consultation with the röntgenologist is necessary; if he is familiar with the vagaries of mammary cancer he will frequently recede from his diagnostic interpretation and admit his uncertainty of the presence of pulmonary metastasis in the presence of a clear axilla. The presence of but a small amount of pulmonary metastasis from a breast cancer is not an easy interpretation for the röntgenologist to make.

The surgeon should pay special attention and give prompt investigation to symptoms complained of by the patient, especially in the back, pelvis, or the knees. If the patient complains of "lumbago" or "rheumatism" in the hips or knees, a plate should invariably precede surgical intervention. In such a case it is common to have the plate reveal metastasis into the spine or pelvis. Patients especially complain of pain in the knees when the metastasis is located about the acetabulum.

It is Doctor Adair's rule to lay a row of gold seeds containing radium emanation, beginning at the very apex and extending to the base in all cases of involved axillæ. In not a few cases where a bad prognosis was anticipated, due to extensive axillary disease, he has been impressed with the effectiveness of this procedure and felt that the good results were due to the employment of interstitial irradiation.

DR. WILLY MEYER stated that at the time when the American Surgical Association reviewed the question of cancer of the breast it was positively shown that patients' lives had been greatly lengthened from the moment that radical cancer surgery of the breast was introduced. The statistics presented at that time were most convincing. The first patient whom Doctor Meyer operated upon in 1894, according to the principles as always advised by him,

lived for over thirty years and her case had been one of ulcerating cancer of the breast. In this case both pectoral muscles and the entire axillary contents were removed in one piece. Doctor Meyer endorsed the technical additions of George Semken, who also removes the sheath of the axillary vein and the entire fascia covering the serratus and intercostal muscles.

Doctor Meyer considered it a grave mistake not to remove the entire axillary contents, just because axillary nodes are not palpable on physical examination before operation. In every instance radical operation demands that the entire cancer field with the lymph-nodes should be removed and one should not trust to irradiation or the implantation of radium seeds to do the work the knife should do.

If any surgeon wants to satisfy himself that the above-described radical surgery is essential let him view those magnificent microscopical slides of Doctor Wainwright's, of Scranton, Pennsylvania. These slides prove the vital necessity of removing the entire pectoralis major and minor muscles with the cancer field if a real radical operation is to be performed. This type of operation is the hope and the future of the breast cancer patient.

DOCTOR KLINGENSTEIN, in closing the discussion, wanted to correct the impression of Doctor Adair that the results in the series just reported compared unfavorably with a series published in 1926. The difference between the 36 per cent. five-year cures reported in 1926 and the 23 per cent. now reported rests upon the fact that the 36 per cent. refers to cases followed only for a five-year period; whereas the 23 per cent. deals with patients followed for at least five years. It will be remembered that cases were reported this evening as suffering from recurrence or succumbing after a five-year period of apparent well being. He hoped that the question of classifying unfollowed cases as dead of cancer might be obviated in the future by our ability to follow each and every patient operated upon with any type of cancer, by reason of a more complete and extensive follow-up service.

#### EDITORIAL ADDRESS

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